

NEEMUCH-PACHPAHAR-GOONA RAILWAY

AND

KOTAH FEEDER RAILWAYS

RECONNAISSANCE REPORT

1919-20

BY

C. A. H. EDWARDS, *Executive Engineer,*
RAILWAY DEPARTMENT (RAILWAY BOARD).



COMPLIMENTARY

NEEMUCH-PACHPAHAR-GOONA RAILWAYS AND
KOTAH FEEDER RAILWAYS.

Reconnaissance Report and Rough Estimates, 1919-1920.

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CONTENTS.

General Information.

	Page.
1-4 References	1
5-9 History of the project	1-3
✓ 10 Boundaries of country under survey	3
11-12 Object of reconnaissance and extent of Field work	3
Map showing various proposals	3

General Survey of the Project.

13-16 Physical aspects	7
17-21 Traffic conditions	7-8
✓ 22 Industries	8
23-24 Agriculture	8-9
✓ 25 Trade centres	9
✓ 26 Communications	9
✓ 27 Traffic prospects	10
✓ 28 Conclusions	10
29-34 Selection of routes for survey	10-11
35 Division of the Project	12

NEEMUCH-PACHPAHAR-CHHABRA CHORD.

PART I.

Neemuch to Pachpahar.

1 Preliminary	15
2 Gauge	15
3 Fixed point	15
4 Length of line	15
5 Gradients and curves	15
6 Location	15
7 Alternative routes	16
8 Extensions	16
9 Junctions	16
10 Rates and wages	16
11 Building materials	16
12 Relations with the public and Government Departments	16
13 Proposed stations	17
14 Description of principal places having stations	17
15 Standard of construction	17
16 Construction and engineering	18
17 Rainfall	18
18-19 Probable cost of construction	18
20-30 Probable gross earnings	19-23
31 Comparison with gross earnings of adjacent sections of existing railways.	23
32 Working expenses	24
33 Net earnings	24
34 Dividend prospects	24
36 Competition with existing lines	24
36 Length of line in each Native State	25
37 Advantage of the line from the point of view of economic development.	25

CONTENTS.—*contd.*

PART II.

Pachpohar to Jhalrapatan.

Paragraphs.	Page.
1 Preliminary	29
2 Gauge	29
3 Fixed point	29
4 Length of line	29
5 Gradients and curves	29
6 Location	29
7 Alternative routes	29
8 Construction and engineering	30
9—10 Probable cost of construction	31
11—22 Traffic prospects	31—36
23 Working expenses	35
24 Net earnings	36
25 Dividend prospects	36
26 Diversion of traffic	36

PART III.

Jhalrapatan to Chhabra.

1 Preliminary	39
2 Gauge	39
3 Fixed point	39
4 Length of line	39
5 Gradients and curves	39
6 Location	39
7 Alternative routes	40
8 Junctions	40
9 Construction and engineering	40
10—11 Probable cost of construction	40—41
12—18 Traffic prospects and gross earnings	41—44
19 Working expenses	44
20 Net earnings	44
21 Financial results	44

PART IV.

FEEDER RAILWAYS.

Gauge 2 ft. 6 inches.

✓ (i) *Baran to Etawah.*

1 General remarks	47
2 Gauge	47
3 Construction and engineering	47
4 Location	47
5 Gradients and curves	48
6 Junctions	48
7—8 Probable cost of construction	48
9—14 Traffic prospects and gross earnings	48—51
15 Working expenses	51
16 Net earnings	52
17 Dividend prospects	52

CONTENTS.—*contd.*PART IV.—*contd.**(ii) Baran to Aklera, with a branch to Sangod.*

Paragraphs.		Page.
1	Gauge	52
2	Fixed point	52
3	Length of line	52
4	Gradients and curves	52
5	Location	52
6	Alternative routes	52
7	Extensions	53
8—9	Probable cost of construction	53
10—14	Traffic prospects and gross earnings	53—54
15	Working expenses	55
16	Net earnings	55
17	Dividend prospects	55

(iii) Aklera to Manohar Thana.

1	Gauge	55
2	Fixed point	55
3	Length of line	55
4	Gradients and curves	55
5	Location	55
6	Alternative routes	56
7—8	Probable cost of construction	56
9—13	Traffic prospects and gross earnings	56—57
14	Working expenses	57
15	Net earnings	57
16	Dividend prospects	57
17	Total mileage of Feeder Railways in Kotah State	57

(iv) Jhalrapatan to Salamatpur.

1	Gauge	58
2	Fixed point	58
3	Length of line	58
4	Gradients and curves	58
5	General remarks	58
6	Junctions	58
7	Location	59
8	Alternative routes	59
9	Extensions	59
10	Construction and engineering	59
11—12	Probable cost of construction	59
13—19	Traffic prospects and gross earnings	60—62
20	Working expenses	62
21	Net earnings	62
22	Dividend prospects	62

Basrasia to Sironj (Branch).

1	Preliminary	63
2	Gauge	63
3	Fixed point	63
4	Length of line	63
5	Gradients and curves	63
6	Location	63
7	Probable cost of construction	63
8—11	Traffic prospects and gross earnings	63—64
12	Working expenses	64
13	Net earnings	64
14	Dividend prospects	64

CONTENTS.—*concl'd.*

PART IV.—*concl'd.*

(v) *Jhalrapatan to Ujjain via Agar.*

Paragraphs.	Page.
1 Gauge	64
2 Fixed point	64
3 Length of line	64
4 Gradients and curves	64
5 General remarks	64
6 Location	65
7 Construction and engineering	65
8—9 Probable cost of construction	65
10—15 Traffic prospects and gross earnings	65—66
16 Working expenses	67
17 Net earnings	67
18 Dividend prospects	67
SUMMARY OF RESULTS	67
CONCLUSIONS AND RECOMMENDATIONS	67
APPENDICES	69—75

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GENERAL INFORMATION.

REFERENCES.

1. Railway Board's letter No. 468-P.—16, dated 24th September 1919, to Mr. C. A. H. Edwards, Junior Government Inspector of Railways, Circle No. 6, forwarding the following proceedings of the Government of India in the Railway Department:—

Construction, December 1914, A., Nos. 332-6.

Construction, June 1915, A., Nos. 207-11.

Projects, October 1916, A., Case No. 468-P.—1—7.

Projects, April 1917, A., Case No. 696-P.—16-1.

Projects, November 1917, A., Case No. 468-P.—16-8—9.

2. Railway Board's letter No. 468-P.—16, dated 23rd October 1919, forwarding a copy of a letter No. 3012, dated 24th September 1919, from the Hon'ble the Agent to the Governor-General in Central India to the Government of India in the Foreign and Political Department. (Appendix I.)

3. Letter No. 3541, dated 17th October 1919, from the Secretary to the Hon'ble the Agent to the Governor-General, in the Public Works Department, Central India, to Mr. C. A. H. Edwards, forwarding a copy of his No. 3540, to the Secretary, Railway Board, putting forward the suggestions of the Indore Darbar. (Appendix II.)

4. *Gazette of India* notification No. 1776-E.—19, dated 15th November 1919.

History of the project.

5. In July 1913, the Kotah Darbar asked for the general approval of the Government of India to a fairly comprehensive scheme of light railway construction to develop the interior of the Kotah State. The railways were to be of the 2 feet 6 inches gauge. The following lines were contemplated:—

(i) From Etawah in the north to Manohar Thana in the south, crossing the Baran Kotah broad gauge railway at Baran, and passing through Sangod and Arnia.

(ii) A branch line from Sangod *via* Kanwas to Darah, a station on the Nagda-Muttra section of the Bombay, Baroda and Central India Railway.

(iii) A branch line from Arnia *via* Asnawar and Jhalrapatan through a portion of the Jhalawar State, to Shri Ohhatrapur, a station on the Nagda-Muttra section of the Bombay, Baroda and Central India Railway.

The total length of the proposed railways was approximately 170 miles, but 19 miles passing through the extreme north of the Jhalawar State, and

connecting Jhalrapatan, the capital of that State, to Shri Chhatrapur station on the Bombay, Baroda and Central India Railway.

The construction was to spread over a term of years and the section built in order of urgency; the Kotah State requiring no outside financial assistance.

The views of the Jhalawar Darbar, of the Bombay, Baroda and Central India Railway and Great Indian Peninsula Railway administrations were asked for with the following result :—

The Jhalawar Darbar were ready to co-operate with the Kotah Darbar.

The Bombay, Baroda and Central India Railway, supporting the scheme of the Kotah Darbar, were ready to give every assistance and suggested that the section from Etawah to Baran should be built first.

The Great Indian Peninsula Railway administration were also well disposed towards the projected railways, but objected to the connections to the west with the Bombay, Baroda and Central India Railway.

They were also anxious that no preference should be given to the Bombay, Baroda and Central India Railway.

6. In May 1916, two further proposals were put up by an independent party to the Railway Board; one suggesting the construction of a railway from Pachpahar, a station on the Nagda-Muttra (broad gauge) section of the Bombay, Baroda and Central India Railway to Jhalrapatan, with a possible future extension to Goona station on the Bina-Baran section of the Great Indian Peninsula Railway. The second proposal was for a chord between Neemuch station on the Malwa (metre gauge) section of the Bombay, Baroda and Central India Railway to Pachpahar station on the Nagda-Muttra (broad gauge) section of the same railway.

7. These new proposals were put up to the various parties concerned for remarks. The Kotah Darbar do not disapprove of them. The Jhalawar Darbar support the proposals and prefer Pachpahar as a junction on the Nagda-Muttra Railway. The Bombay, Baroda and Central India Railway agree with the Jhalawar Darbar on this point, because Pachpahar is an engine watering station and water is both bad and difficult to obtain at Shri Chhatrapur. As regards the line from Neemuch to Pachpahar, the Bombay, Baroda and Central India Railway administration are diffident as to its necessity and are opposed to its construction till it is proved that the requirements of the district traversed justify the demand for such a line.

The Great Indian Peninsula Railway adhere to their original opinion and do not favour any extensions to the west by the proposed Kotah Feeder railways.

The Great Indian Peninsula suggest that the following lines might be considered :—

- (i) From Pachpahar to Jhalrapatan.
- (ii) From Ujjain to Agar.
- (iii) From Baran, crossing the Parwan river, to Bapour, Khanpur, Sarola, Taraj, Aklera and Manohar Thana.
- (iv) From Bhopal (or Sanchi) to Barasia, Narsinghgarh, Bioara and Rajgarh, with a branch northward on the west of the Betwa river in the direction of Sironj.

They doubt very much whether the lines, when surveyed, will prove worthy of support on feeder line terms.

8. The Indore Darbar, through whose territory a great portion of the Neemuch-Pachpahar-Goona chord will pass, say that the best alignment for connection between the Malwa (metre gauge) and Nagda-Muttra (broad gauge) section of the Bombay, Baroda and Central India Railway lies more or less along the existing metalled road from Neemuch to Shri Chhatrapur. They also suggest that a preferable alternative to the line from Pachpahar to Jhalrapatan would be a line from Pachpahar to Raipur through Sana

connecting there with an extension of a line projected by the Gwalior Darbar from Ujjain to Sohet, which could be extended to Jhalrapatan. (Appendix II.)

9. The Hon'ble the Agent to the Governor-General in Central India agrees with the Indore Darbar as to the alignment of the Neemuch-Pachpahar chord, and suggests from personal knowledge of the country, that Chhabra or Rothini would be better as a junction on the Bina-Goonna-Baran Railway, as the line would then avoid the difficult country lying west of Goona. (Appendix I.)

Boundaries of the country under reconnaissance.

10. The country surveyed is bounded on the north-west by the Rampura-Bhanpura hills and the Chambal river; on the north-east and east by the Parbati river and the railway from Baran to Bina; on the south-east and south by the railway from Bina to Rudram; on the west by the (Ajmere-Khandwa) Malwa section of the Bombay, Baroda and Central India Railway.

Object of the reconnaissance and extent of field work.

11. The object of this reconnaissance survey is to select general routes for a satisfactory scheme of railway extensions for the economic development of the area mentioned in paragraph 10 above. With this object in view, the physical and traffic conditions of the whole area have been studied before examining any particular line. In the light of the definite information thus obtained, the various proposals have been co-ordinated into one homogeneous project.

The only instrumental work done was confined to observations with the aneroid barometer, the prismatic compass and the Abney level.

All lines suggested or proposed and any alternative which fitted in with the general scheme were scrutinised. The passes through the various ranges of hills and any country which appeared at all difficult have been examined carefully.

12. The map overleaf shows all the various lines proposed or suggested above.

GENERAL SURVEY OF THE PROJECT.

Physical aspects.

13. If the index map is examined, it will be seen that the country under report is naturally divided into three sectors, viz. :—

- (i) The area enclosed between the Rampura-Bhanpura hills, the Nagda-Muttra, the Nagda-Rutlam and the Malwa sections of the Bombay, Baroda and Central India Railway.
- (ii) The triangle formed by the Chambal and Parbati rivers from their confluence as apex, to the Baran-Kotah Railway as base.
- (iii) The country enclosed by the railway lines from Kotah to Baran, Baran to Bina, Bina to Nagda and from Nagda to Kotah.

14. Sector (i) lies in the Malwa plateau. A fertile undulating plain, at the foot of the Rampura-Bhanpura hills, a branch of the Vindhyan range, striking across from west to east, north of Neemuch from Chitor to Chanderi. This range of hills forms the northern boundary of the table-land from which it rises abruptly. The plateau slopes gently eastwards towards the Chambal river which, with its tributaries, constitutes its main drainage. The country, in this sector, offers no great difficulty to the construction of a railway.

15. Sector (ii) is entirely in the alluvial plain lying between the Chambal and Parbati rivers. Railway lines running parallel to these rivers will be of particularly easy construction.

16. Up to the Mukandwara range of hills, north-east of Jhalrapatan, sector (iii) presents no difficulties and is merely an extension of the undulating Malwa plateau. From there, however, the country becomes more difficult. Besides the Mukandwara hills and several other small ranges, the country is studded with crags and rocky eminences more or less irregularly connected. This is more accentuated in the centre and in the east; especially west of Goona. The country is drained by six big rivers and their tributaries. The rivers are the Chota Kali Sind, the Au, the Kali Sind, the Parwan, the Parbati and the Betwa. The first four mentioned are themselves tributaries of the upper Chambal river. A line drawn from Schore on the Bhopal-Ujjain Railway through Barasia, Sironj and on to Shahdaura on the Bina-Baran Railway, practically demarcates the watershed between these tributaries and the Betwa. The hills, like the rivers, in this sector run very nearly north and south and are distinct barriers to east and west connections. North and south routes can easily be found.

Traffic conditions.

17. Trade is almost entirely confined to the export of the surplus agricultural produce and the import of domestic commodities and petty luxuries. The general distribution is very uneven and the influence of the existing railways is very marked. The country is mainly agricultural and a little over 50 per cent. is actually under cultivation. From the various statistics consulted, I roughly estimate the present potential imports and exports to average 2·8 and 3·4 maunds respectively per capita per annum. The main exports are :—Grain, oilseeds and cotton. The imports are :—Salt, sugar, wheat, rice and piece-goods.

Grain, oilseeds and cotton are chiefly exported to Gujarat and Bombay. Of the imports, salt and piece-goods come from Bombay generally; wheat, sugar and rice from the north.

18. Imports.—

Serial No. in order of importance.	Commodity.	Places of import.
1	Grain including rice	Punjab.
2	Salt	Bombay.
3	Sugar and gur	Oudh and Rohilkhand Railway,
4	Groceries	Bombay and Gujarat.
5	Piece-goods and cloth	Ditto ditto.
6	Tobacco	Bombay.
7	Iron and other metals	Do.
8	Kerosine oil	Do.

19. Exports.—

Serial No. in order of importance.	Commodity.	Place of Export.
1	Grain	Bombay, Marwar, Gujarat, Kathiawar.
2	Cotton	Bombay, Gujarat.
3	Oil-seed	Bombay.
4	Hides	Do.
5	Cattle	Gujarat, Kathiawar.
6	Ghee	Bombay.
7	Opium	Ghazipur.
8	Vegetable oil	Bombay.

20. The population averages about 116 to 120 per square mile. The material condition of the people, judging by the clothing, utensils and state of the villages, seems fair in towns and near the railway, but is poor in the interior. I estimate that on an average they make 3·3 trips on the railway per annum contributing Re. 0·9 per capita to the railway per annum.

21. The exports and imports are carried to and from the nearest best market, not necessarily the nearest railway station, by either carts or pack animals. There is no shortage of either; but labour is not plentiful. There is a fair mileage of metalled roads, which is yearly increasing. Fair weather roads are numerous and are generally in a very good state of repair. The freight charged varies with the locality, the distance, nature of road, and the chances of getting a back load. As an average, it may be taken at pies six per maund mile.

The crops are usually sold by the cultivators on the threshing floor, but they are sometimes sold standing. If, as is usually the rule, the cultivator is in debt to the village "baniah," he has to sell his crop to him. If not, he can select his own market and deals with brokers who visit the villages to buy the produce of the fields. He does not deal directly with the "mandi," because his holding is so small.

The price, which the cultivator gets, is the prevailing price at the nearest mandi, less the cost of transport and the broker's profit. The rate paid by the "baniah" is very much less. "Mandis" are nearly always at the railway stations. Their rates vary according to the demand and the lead to final destination.

Industries.

22. The industries, though capable of development, are at present entirely of a local character. They are so small, that they do not figure in the trade and may be dismissed for the present without further mention. They will naturally benefit by the advent of railways which will foster their development, but they do not at this stage constitute a factor affecting the selection of general railway routes. They will be taken into account when examining individual lines.

Agriculture.

23. The country on the whole is fertile and the rainfall is fairly regular. Very little irrigation is done from rivers or tanks; the few wells here and there are the main sources of irrigation. The famine of 1900, which was severe, and general, seems to be the only one remembered. Shortage of or untimely seasonal rains causes a certain amount of scarcity occasionally. Most of the area produces two crops yearly. The methods of cultivation seems primitive, but with the impetus due to the high prices obtainable now, increased production will naturally follow. The cultivator wants to be in closer touch with his market; he needs a shorter lead for disposing of his surplus produce and a cheaper and quicker transport. Exclusive of other advantages, he will obtain all these by the advent of railways and, further more, the labour which is now taken away from the fields to transport the produce to markets sometimes more than 40 miles away, at a time when it can ill be spared, will be continuously available for cultivation.

24. Rotation of crops.—

Name of crops.	When sown.	When harvested.	Average yield per acre.
Kharif—			
Makka . . .	June and July . . .	October . . .	12½ maunds.
Juar . . .	July . . .	December-January . . .	5 „
Tilli . . .	July-August . . .	November . . .	1½ „
Cotton . . .	June-July . . .	December-January . . .	{ 3½ maunds irrigated.
Fodder . . .	Do. . .	October to December . . .	{ 1½ maund dry.
			15 maunds.
Rabi—			
Wheat . . .	October-November . . .	March-April . . .	{ 3½ maunds dry.
Barley . . .	November-December . . .	March . . .	{ 10 „ irrigated.
Gram . . .	October . . .	Do. . .	10 maunds.
Linseed . . .	October-November . . .	Do. . .	3½ „
Poppy . . .	November-December . . .	February-March . . .	2½ „
			7½ „ irrigated.

Trade centres.

25. With the advent of railways, trade has gradually shifted from those less fortunately situated centres to places on the railway. Many of the old towns have kept their importance, but they struggle under a great handicap. If we leave out the trade centres which are on the railway, we have to name only the most important ones:—

In sector (i).

Sitamau
Manassa

Rampura.
Bhanpura.

In sector (ii),

There are no real towns like those in sectors (i) and (iii); the centres are only villages with their trade bases at Baran and Kotah.

In sector (iii)

Jhalrapatan
Susner
Nalkera
Sangod
Narsinjbgarh

Sunel
Pirawa
Machalpur
Aklera
Sironj

Raipur
Dug
Kilohipur
Manohar
Bairasia

Agar
Mehidpur
Rajgarh
Thana, Binora.

In sector (i), Sitamau trades through Mandasor, a station on the Malwa section of the Bombay, Baroda and Central India Railway. Manassa, Rampura and Bhanpura traffic comes to the Nagda-Muttra Railway at Garot.

The direction of the traffic in sectors (ii) and (iii) is better illustrated on the map; the country within the coloured edging is the tributary territory of the Nagda-Muttra and the rest is that of the Great Indian Peninsula Railway. The map was compiled from local inquiries. It is very striking how far the influence of the Nagda-Muttra section extends. The only reason, which I can find for this, is the shorter lead for both exports and imports. The lead to final destination affects a good deal the rates at the "mandis."

Communications.

26. On the whole, though roads are numerous and generally very fair, trade communications are poor. The roads were built before the railways to suit the conditions prevailing then. The railways have changed the direction of the traffic, and so the roads which, like the rivers, hills and railways, themselves run practically north and south, are not in the direction wanted now; that is, east and west to tap the railways as quickly as possible. This absence of east and west connections is very marked. Railways average 3.74 miles per 100 square miles of country. In sector (i) which is, for practical purposes, a triangle with Rutlam as apex and the Rampura-Bhanpura hills as base, the Malwa and Nagda-Muttra Railways, running from south to north, form the

sides of the triangle and are 61 miles apart at the base. Sector (ii) is enclosed between big unnavigable rivers and has to depend entirely on road transport to carry its grain to Baran or Kotah. Sector (iii), which may be taken as a parallelogram bounded by railways, has an area of about 15,000 square miles. Its sides are roughly 105 and 144 miles apart respectively. The interior of this sector can hardly be said to be served at all by railways.

Traffic prospects.

27. Actual traffic earnings of the individual sections of the lines serving at least part of the country under survey have not been available (*vide* Appendix III), and so it is not easy to guess at the probable earnings of the proposed railways. But the country appearing prosperous, one would expect the railways to be so too. However, I find that it is not so with the Baran-Kotah and Baran-Bina Railways. The former, on an average for 11 years, has paid a dividend of only 1.5 per cent. per annum and the latter 2 per cent. The only reasons which I can find for such poor returns from the Baran-Kotah which passes through fairly rich country, are :—

- (a) that the line appears overcapitalized.
- (b) that it is worked by the wrong agency.

The Baran-Kotah has cost Rs 1,15,358 per mile; it is laid with 87 lbs. rails and equipped to the standard of the best of main lines for one train a day each way.

Baran is the largest trade centre in the Kotah State. Its business is largely connected with Kotah, where the capitalists live. Its imports and exports are mainly to and from Bombay, Gujarat and stations on the Bombay, Baroda and Central India. Baran is 615 miles from Bombay *via* Kotah and the Bombay, Baroda and Central India Railway and 754 miles from Bombay *via* Bina and the Great Indian Peninsula Railway. Yet, the Baran-Kotah is worked by the Great Indian Peninsula Railway. The interests of the trade of the Baran-Kotah and those of the Great Indian Peninsula Railway are diametrically opposed; and the efforts of the Great Indian Peninsula to divert the trade *via* their own line, can but retard all development of the tract of country served by the Baran-Kotah. Traffic is actually being carted from Baran to Durrach and Kotah owing to the almost continuous restrictions of booking from Baran *via* Kotah, and one of the lines proposed by the Kotah Darbar, from Baran to Durrach, has been suggested by the merchants of Baran with the avowed intention of diverting their traffic to the Bombay, Baroda and Central India at Durrach.

From the above it is evident that the agency, which is going to work the proposed lines, must be selected according to the direction of the traffic as otherwise the earnings will be seriously affected.

Conclusions.

28. As stated in paragraph 11, the lines projected are to be, at the beginning at least, more economic and administrative measures than financial enterprises. Such being the case, I arrive at the conclusion that the best system suited to this end is :—

- (i) A through east and west connection from the Malwa section of the Bombay, Baroda and Central India Railway to the Baran-Bina section of the Great Indian Peninsula, passing through the most important places.
- (ii) Cheap feeder railways north and south of this through line; not disjointed units, but a more or less connected system which could be centrally managed.

— Selection of routes for survey.

29. Through east and west connection.—The proposals made by the local parties interested in this, *vide* paragraph 6, differ only in minor details of alignment. The general route is the same and is, in my opinion, correct. The line will start from Neemuch, the furthest north-western corner of the area,

and, following the old trade route *viâ* Manassa and Rampura, will cross the Nagda-Muttra at or near Shri Ohhatrapur and then *viâ* Jhalrapatan, proceed to the Baran-Bina Railway.

Shri Ohhatrapur will not do as a junction on the Nagda-Muttra Railway. Water there is difficult to obtain and also is not fit for locomotive consumption (*vide* results of chemical analysis Appendix V).

Pachpahar, the next station to Shri Ohhatrapur on the Nagda side, is already a watering station and is in every way more suitable. It has a large and growing "mandi," while there is none at Shri Ohhatrapur.

The best junction on the Baran-Bina is undoubtedly Chhabra. Goona and Rothiai, which have been suggested as junctions, are both difficult of access from the west. It would also mean an extra big bridge over the Parbati river and an unnecessary extra length of 20 miles through difficult country.

I, therefore, recommend the Neemuch-Pachpahar-Jhalrapatan-Chhabra route for the east and west connection.

Feeder Railways.

30. Good and well built tramways on the 2' 6" gauge will meet the demand for feeder railways. They can be cheaply built more or less along the existing roads for the most part. Rather than go to the expense of building big bridges over the important rivers, I would suggest crossing them by dips using the present masonry causeways. I am told that the rivers are very seldom unfordable for more than 6 to 8 days at a time. Traffic will only be interrupted during these periods, which occur during the rains when very little is going on. After a time, when and where necessary, bridges can be built. I do not think that conversion to a wider gauge will ever be necessary.

31. In sector (i), the line from Neemuch to Pachpahar will fully meet its present needs and no feeder railway appears necessary.

32. In sector (ii), I think the line proposed by the Kotah Darbar from Baran to Etawah *viâ* Ayana and Mangrol is all that is required. It connects the granaries to the trade centre at Baran.

33. In sector (iii) the feeder lines on the north of the chord from Neemuch to Ohhabra will be all entirely in Kotah State. The proposals of the State here are :—

1. Baran to Durrah *viâ* Sangod.
2. Sangod to Aklera.

The first proposal is objectionable, because it will be in direct competition with the Baran-Kotah Railway on which Government already lose Rs. 60,000 annually. The line is intended to divert the Baran traffic to the Bombay, Baroda and Central India Railway at Durrah and counteract the legitimate efforts of the Great Indian Peninsula Railway to divert the Baran traffic to their own line. Instead of the above lines I would suggest the following, as meeting the case better.

1. Transfer the working of the Baran-Kotah Railway to the Bombay, Baroda and Central India in lieu of the construction of the feeder railway from Baran to Durrah.

2. Build the feeder from Baran to Aklera *viâ* Bopour and Khanpur with a branch to Sangod only.

34. The country to the south of the Neemuch-Ohhabra chord offers greater difficulties to a system of united feeder railways on account of the plurality of conflicting interests. But I think the lines enumerated below, if feasible, will serve the country well and afford immediate relief to where it is most wanted. The feeder railways I suggest are :—

1. Aklera to Manohar Thana.
2. Jhalrapatan to Salamatpur *viâ* Raipur, Soheli, Machalpur, Kilchepur, Rajgarh, Binaora, Narsinghgarh, and Bairasia.
3. A branch line from the above Bairasia to Sironj.

4. Ujjain to Agar, and Jhalrapatan joining with 2 at Sohet. The section Sohet to Jhalrapatan being common to both 2 and 4.

Division of the project.

25. The project has been divided into :

(a) Through line :

Part I. Neemuch to Pachpahar.

Part II. Pachpahar to Jhalrapatan.

Part III. Jhalrapatan to Chhabra.

(b) Part IV. Feeder Railways.

1. Baran to Etawah, *via* Mangrol and Ayana.

2. Baran to Aklera, *via* Bopour, and Khanpur, with a branch from Bopour to Sangod.

3. Aklera to Manohar Thana.

4. Jhalrapatan to Salamatpur, *via* Raipur, Soyot, Machalpur, Kilechipur Rajgarh, Biaora, Narsinghgarh and Bairasia, with a branch from Bairasia to Sironj.

5. Jhalrapatan to Ujjain *via* Agar.

NEEMUCH-PACHPAHAR-CHHABRA CHORD.

PART I.

NEEMUCH TO PACHPAHAR.

Gauge—3' 3 $\frac{1}{8}$ " (metre gauge).

Length—61·5 miles.

Total cost—Rs. 42,38,150.

Cost per mile—Rs. 68,913.

Percentage of net earnings on total capital outlay 4 per cent

Length of line in each Native State :—

	Miles.
Gwalior	10·12
Indore	42·13
Jhalawat	3·25

NEEMUCH-PACHPAHAR-CHHABRA

PART I.

NEEMUCH TO PACHPAHAR.

Gauge—3' 3 $\frac{1}{2}$ ".

Length—61.5 miles.

1. *Preliminary*.—This line forms part of the proposed chord from the (Ajmere-Khandwa) Malwa (metre gauge) section of the Bombay, Baroda and Central India Railway to the Baran-Bina (broad gauge) section of the Great Indian Peninsula Railway. It will cross the Nagda-Muttra (broad gauge) section of the Bombay, Baroda and Central India Railway at Pachpahar. Its main object is economic; it is to serve the fertile Malwa plateau which has very limited railway communications. It will pass through the towns of Manassa and Rampura and render more accessible the tracks within the Rampura Bhanpura hills.

2. *Gauge*.—Though no engineering difficulty exists to the construction of a broad gauge railway from Neemuch to Pachpahar, the metre gauge has been selected as more suitable for the following reasons:—

(i) The Malwa section of the Bombay, Baroda and Central India Railway, with which the new line will have a good deal of interchange of traffic, is of the metre gauge.

(ii) Neemuch is a metre gauge engine changing station, complete with locomotive shed, etc., and sufficiently equipped to deal with the three or four extra engines which will be required to work the new line. By the introduction of the broad gauge into Neemuch, a good deal of what is there and can carry on for several years more will be scrapped, and extensive and expensive alterations and additions will be required to the yard, locomotive sheds, etc.

The savings affected, without any detriment to traffic, by adopting the metre gauge for the Neemuch-Pachpahar chord may be roughly estimated at:—

Rs.

(a) Difference in cost between the construction of a new metre gauge yard and combined locomotive shed at Pachpahar and the alterations and additions at Neemuch to receive the broad gauge	50,000
(b) Difference in cost of construction between a broad gauge and metre gauge line from Pachpahar and Neemuch	9,60,000
TOTAL	10,10,000

The metre gauge will be ample to carry the local and interchanged traffic of the proposed line.

3. *Fixed point*.—The fixed point, or zero, from which the mileage is reckoned, is the centre of Neemuch station. It is equivalent to mile 150.15 from Ajmer on the Malwa section of the Bombay, Baroda and Central India Railway.

4. *Length of line*.—The length of the line from the centre of Neemuch Station to the centre of Pachpahar station is 61.5 miles.

5. *Gradients and curves*.—The ruling grade is 1 in 200 or 5 per cent. The curvature is very easy, there will be no sharp curves.

6. *Location*.—Once the terminals have been decided upon, the location presents no difficulty and calls for no special comment. It is only a matter of connecting by the shortest route the obligatory points lying between the termini. Leaving the main line of the Malwa section of the Bombay, Baroda and Central India Railway, 2 miles south of the centre of Neemuch station, the

line, avoiding the city of Neemuch makes for Manassa, one of the obligatory points on the route. Then, following the pucca road from Neemuch to Shri Ohhatrapur, through billowy country, Rampura is reached at mile 39. From Rampura, the line turns east-south-east and crosses the Chambal river by a proposed bridge 14 spans of 60 feet girders at mile 43. From there, through broken country, from which it emerges again at mile 53, the line reaches Pachpahar station on the Nagda-Muttra Railway and enters it from the south. The mileage of the centre of Pachpahar station along the proposed line is 61.5. The level of Neemuch is 1599 and that of Pachpahar 1250. The only important river crossed is the Chambal; for the rest, the drainage is easy, and I estimate the waterway required, on the assumption of 11 inches of rain in 24 hours and 2 inches run off, to be 40 lineal feet per mile, exclusive of the waterway for the Chambal and that of the Ansar Nala at mile 48.

7. *Alternative route.*—With the termini fixed, there is no other alternative route; Manassa and Rampura are obligatory points between the termini.

8. *Extensions.*—The natural extension of a line from Neemuch to Pachpahar is that from Pachpahar to the Baran-Bina section of the Great Indian Peninsula Railway which forms the subject-matter of Parts II and III of this report.

9. *Junctions.*—Neemuch has been selected as the starting point on the Ajmer-Khandwa section of the Bombay, Baroda and Central India Railway, because it is the largest trade centre on that section between Rutlam and the Rampura Bhaupura hills. It makes a very good junction, being already a watering and engine changing station. The existing shed and workshop for ordinary shed repairs will be sufficient to deal with the extra engines required to work the traffic of the new chord to start with. It has also a refreshment room and a waiting room.

Pachpahar is a station on the Nagda-Muttra (broad gauge) main line of the Bombay, Baroda and Central India Railway. It has been selected being the next place to Shri Ohhatrapur where a plentiful supply of water fit for locomotive consumption is available, (*vide* analysis Appendix V). It is already a watering station and is the most important and growing trade centre between Nagda and Kotah. The total gross earnings of Pachpahar station were, for the year ending March 1919, Rs. 2,18,133.

I am informed that the water at Shamgarh, the last watering and engine changing station on the Nagda side of Pachpahar, is constantly failing during the hot weather and that water is then taken from Chau Mahla and Pachpahar. I also understand that arrangements are being made to shift the engine changing station to Chau Mahla. If this is the case and if there is any chance of the present project being carried through, it may be worth while making Pachpahar the engine changing station now and thus avoiding waste of money later. The run would only be increased 21 miles from Rutlam and the sections would be :—

	Miles
Rutlam to Pachpahar	104
Pachpahar to Kotah	82

10. *Rates and wages.*—The rates and wages prevailing in the States traversed are low. The construction of the railway will cause considerable modifications. Labour will have to be imported.

11. *Building Materials.*—Building stone of excellent quality, as well as lime stone and kunker for the manufacture of lime, are available locally. But to take advantage of the best quarries, the construction of certain stations and bridges will have to be postponed till the rails reach them.

12. *Relations with the Public and Government Departments.*—The military authorities have not been consulted as to whether they require any extra accommodation at Neemuch. The political officers, as well as the officials of the various Darbars concerned, have been freely consulted and I am very much indebted to them, and to Colonel C. E. Luard especially, for all assistance rendered and much valuable information given. The thanks of the survey

party are due to His Highness the Maharaj Rana of Jhalawar who, besides providing us with an office free of charge, did so much to facilitate our work.

13. *Proposed stations.*—The following is a list of the stations proposed :—

Mileage.	Stations.	Distance. apart.	Class.	REMARKS.
0	Neemuch . . . . .	...	Junction	Engine changing.
10	Reoli	10	3rd	
20	Manassa	10	„	Watering.
28	Kukressar	8	„	
39	Rampura	11	„	Watering.
55	Bhanpura Road	16	„	
62	Pachpahar	7	Junction	Engine changing.

14. *Description of principal places having stations :—*

Neemuch.—Town and British cantonment in the Mandassor district of Gwalior State. The population is about 22,000 ; altitude 1,613 feet above mean sea level. It is the headquarters of the Malwa political agency. It has a large import and export trade and is the residence of wealthy merchants having business transactions with Pachpahar and other stations on the Nagda-Muttra.

Manassa.—The third largest town in the Rampura Bhanpura district of Indore State. Population 4,600. Altitude 1,477. This station will also serve two very large villages : Bhatkeri and Pardha. At the latter iron mines were formerly worked and the remains of furnaces are still visible. Manassa dates from the 12th century. Its exports go *viâ* Garoth station on the Nagda-Muttra.

Kukressar.—A large village on the Piplia-Manassa road, and headquarters of a thana.. On the banks of a tank stands a temple of Mahadev, which has a great reputation locally. A weekly hat is held every Tuesday and a religious fair on the Shivaratri.

Rampura.—A town and headquarters of the pargana of the same name. The altitude is 1,300 ft. above mean sea level and the population 11,935. The town is famous locally for its inlaid metal work, manufacture of swords and jewellery. On a hill to the north of the town, there is a very old temple where a fair is held annually. Rampura is the home of many wealthy Bhoras who carry on various trade. A motor service for passengers only run to and from Garoth station on the Nagda-Muttra. There are four flour mills in the neighbourhood. There is also a tile factory and the manufacture of vitrified clay pipes is contemplated. The progress of the town is considerably handicapped by its distance from the existing railways.

Bhanpura Road.—The station is 7 miles from the town of Bhanpura. The population is about 5,000 and the altitude 1,344 ft. above mean sea level. It is a very old town and contains many interesting old buildings. In former days iron smelting was carried on to a considerable extent at a village not very far away and a gun foundry existed at Bhanpura. The trade of Bhanpura goes mostly to Garoth.

15. *Standard of construction.*—The rough estimates have been prepared on the assumption that only the minimum necessary for working the new line will be provided for to start with. Such accessories as high level goods and passenger platforms, goodsheds, etc., being added later when and where they

are found from working experience to be required. In country like the one which will be traversed by the proposed railway, the cost of buildings and equipment is an important factor in determining original outlay.

16. *Construction and engineering.*—The earthwork and bridging present no difficulty. The soil is mostly black cotton and a few cuttings will be in moorum. There will be no rock cutting. The rivers are practically dry in the cold weather, and rock foundations will generally be obtainable at shallow depths.

There are two important bridges, viz.:—

the Chambal river at miles 48 14 by 60 ft. girders ;

the Ansar nala at mile 48 8 by 60 ft. girders ;

Fencing.—No fencing is provided for. For those portions where the railway and the road are contiguous, cactus hedges may be grown as a fence. Gate lodges are only provided for at the important level crossings.

Permanent way.—The permanent way will consist in the main line of B. S., F. E., 50 lbs. steel rails laid on Jodka teak half round sleepers, 2,000 per mile. In sidings second hand $41\frac{1}{2}$ lbs. rails will be used. The ballast will consist of broken stone 10 cubic feet to the lineal foot in the main line, and 7 cft. in sidings.

Platforms.—The passenger platforms will be 600 feet long and 25 feet wide at rail level.

Station and buildings.—All stations are third class, equipped to the minimum necessary to deal with the estimated traffic. At Neemuch, provision for junction arrangements as well as extra accommodation for stabling two more trains is made. Extra quarters for locomotive and traffic have also been estimated for. At Pachpahar, junction arrangements, transshipment yard for two metre gauge trains a day, combined broad and metre gauge locomotive sheds and extra accommodation in the station building have been estimated for. A liberal allowance for locomotive and traffic quarters has also been made.

The provision of watering stations is ample and standard equipment allowed for.

Engines and rolling stock.—The estimate for rolling stock has been based on actual requirements for the estimated traffic. New stock is provided for, though it is known that old stock will be used on the new line and the new stock charged to the new line used on the main line.

17. *Rainfall.*—The rainfall averages 31 inches a year.

18. *Rough estimate of the cost of construction.*—The probable cost of the construction of the Neemuch Pachpahar chord on the metre gauge, as detailed below, works out at Rs. 42,38,150 or Rs. 68,913 per mile.

19. Abstract of the probable cost of the construction of the Neemuch-Pachpahar (metre gauge) Railway. (Length 61·5 miles.)

Main heads.	Total by main heads.	Rate per mile.	REMARKS.
	Rs.	Rs.	
I. Preliminary expenses	30,750	500	
II. Land	18,450	300	
III. Formation	5,68,500	9,000	
IV. Bridgework	7,88,000	12,813	
V. Fencing, etc.	30,750	500	
VI. Electric telegraph . . . . .	...	...
VII. Ballast and permanent way	17,40,450	28,300	See Appendix VII,
VIII. Stations and buildings	1,84,500	3,000	
IX. Plant	30,750	500	
X. Ferries . . . . .	...	...
XI. Rolling stock	6,15,000	10,000	
XII. General charges	2,46,000	4,000	
Total	42,38,150	68,913	

TRAFFIC AND DIVIDEND PROSPECTS.

20. *Gross earnings.*—The prospects of both passenger and goods earnings are good not only on account of the highly fertile soil and the populous centres along and in the vicinity of the line, but also on account of the trade and administrative connections existing between the different places themselves and between the termini. The new line will not be affected by any export restrictions which the States may impose, as even in that case the surplus produce will have to go to either Indore or Gwalior and the line will get a through lead in either case. It is only to be hoped that the new line will not be starved of wagons like the section between Rutlam and Neemuch. The Bombay, Baroda and Central India Railway are just now absolutely unable to cope even with the local traffic between Neemuch and Mandassor. This leads to a great loss to the railway as well as to the trading community. Several mills have had to stop work temporarily on account of shortage of coal and raw materials as the railways are unable to supply wagons for either.

21. *Estimated coaching earnings.*

Stations.	No of villages served.	Population served.	Probable daily No. of passengers.	Distance for charge.	Daily passenger miles.	Rate.	GROSS EARNINGS.	
							Daily.	Annual.
				Miles.			Rs.	Rs.
Neemuch . .	...	...	20	62	1,240	Pies 3 per passenger mile.	19	6,935
Booli . .	48	12,900	50	10	500		8	2,920
Manassa . .	60	25,800	254	20	5,080		79	28,835
Kukressar . .	67	18,000	180	18.0	3,248		52	18,980
Rampura . .	84	30,980	{ 100 200	39	3,900		133	48,545
Bhanpura Road .	33	18,610		23	4,600		19	6,935
Pachpahar . .	...	...	20	62	1,240		19	6,935
Total . .	...	101,290	898	...	21,092		329	1,20,085

Gross coaching earnings	Rs. 1,20,085
Coaching earnings per mile per week	Rs. 38
Average passenger lead	Miles 23
Average earning per capita	Rs. 1.1
Average number of trips per capita	No. 3.2

22. *Comparison with passenger earnings on adjacent lines.*—As on the estimate of coaching earnings for the proposed railway from Neemuch to Pachpahar, I have abstracted from the traffic statistics of the Bombay, Baroda and Central India Railway, the earnings station by station for:—

(a) Broad gauge. The section of the Nagda-Muttra from Mehidpur Road to Shri Ohhatrapur; a length of 77 miles.

(b) Metre gauge. The length from Neemuch to Jaora of the Malwa section; a length of 62 miles.

These two sections pass through the adjacent country which is, if anything, not so rich.

23. (a) Coaching earnings on section of Nagda-Muttra Railway. (Broad gauge) :—

Mileage from Colaba.	Stations.	Population served (estimated.)	Daily No. of passengers (actual No.)	Actual coaching earnings per annum.	REMARKS.
				Rs.	
445	Mehidpur road	12,744	179	29,814	
451	Lurnicha	8,780	76	8,700	
459	Gadgucha-Alot	20,160	224	40,314	
...	Thuria . . . . .	...	13	1,316	
473	Chau Mahla	13,480	117	23,788	
482	Suvāra	9,120	84	14,182	
491	Shamgarh	8,440	66	14,110	
497	Garoth	17,760	129	39,830	
504	Kurlasi . . . . .	...	8	972	
512	Pachpahar	28,000	203	79,032	
522	Shri Chhatrapur	12,000	149	52,914	
	TOTAL	190,464	1,248	3,01,520	

Length of section Miles 77

Actual coaching earnings per mile per week Rs. 76

Average earning per capita Rs. 2.3

Average No. of trips per capita No. 4

24. (b) Coaching earnings on metre gauge section Neemuch to Jaora :—

Mileage from Ajmer.	Stations.	Population (estimated.)	Actual No. of passengers per day.	Passenger earnings per annum.	REMARKS.
				Rs.	
150	Neemuch	86,000	532	1,95,898	
159	Harkia Khel	19,200	86	10,346	
166	Malbargarh	24,000	126	15,708	
171	Pipla	14,000	129	18,488	
173	Tharod	12,000	54	5,420	
181	Mandassor	54,000	657	1,40,948	
190	Dalanda	24,000	205	21,784	Serves Sitamau and Partabgarh.
202	Dhodar	18,000	185	25,050	
212	Jaora	39,600	679	1,29,350	
	TOTAL	240,800	2,653	5,62,992	

Length of section Miles 62

Actual coaching earnings per mile per week Rs. 175

Average earning per capita Rs. 2.3

Average No. of trips per capita No. 4

25. Comparison:—(Coaching earnings):—

Particulars:	Nagda- Muttra (a) actual.	Malwa section (b) actual.	Neemuch Pachpahar estimated.
Length of line in miles	77	62	62
Coaching earnings per mile per week	Rs. 76	175	38
Earning per capita	Rs. 2·3	2·3	1·1
Number of trips per capita	4	4	3·2

26. *Estimated goods earnings.*—The goods traffic is likely to be good from the beginning, as the people have realized the advantages of a railway, having one on each side 30 miles away. The traffic of Gwalior territory goes to Neemuch; that of Indore goes to Garoth. The figures for the estimate of exports have been obtained from local officers and those for imports from merchants. In this connection my thanks are due to Rai Sahib Seth Narain Dass of Mandassor,

27. Estimate of exports, based on the yield per acre within the expected traffic area.

Stations.	Mileage.	Traffic area.	Population per square mile.	Number of square miles under cultivation.	Average yield in maunds per acre.	Total yield per square mile.	Consumption per square mile.	Balance available for export per square mile.	Total available for export and inter station traffic.	Ton miles.	Freight charged.	Total freight earnings.
	Miles.	Square miles.	No.	Square miles	Maunds.	Tons.	Tons.	Tons.	Tons.	Ton miles.		Re.
Neomuch	0	...	...	...	...	...	...	...	...	...	...	...
Reoli	10	70	...	56	Average 6 maunds per acre.	Say 120 tons, allowing 12 per cent. taxable land.	At 3 lbs. per head per day (allowing for cattle) = 54 tons per annum.	37 tons per square mile.	3,290	32,060	0.09 per ton mile + 1/4 per ton terminal charges.	5,655
Manasa	20	160	...	95	...	...	...	...	7,520	9,15,840	...	24,204
Kukresar	28	144	...	80	...	...	...	...	6,768	2,30,112	...	19,245
Rampura	39	170	...	104	...	...	...	...	7,990	1,83,770	...	18,693
Bhanpura Road	55	108	...	64	...	...	...	...	5,076	85,552	...	8,010
Pachpabar	62	...	...	...	...	...	...	...	...	...	...	...
Total		652	...	400	...	...	...	...	30,684	7,98,154	...	76,717

Estimated earnings from exports per mile per week

Rs. 23

Average load

Miles 26

Average export per capita

Ton 0.31

Average earnings per capita

Re. 0.77

28. *Imports.*—The revenue and customs figures of the States are not of much use to estimate the probable imports, and I had to get figures from leading merchants and strike an average per square mile. I arrive at the conclusion that the probable imports will average $33\frac{1}{2}$ tons annually per square mile. On this assumption, the freight earnings from imports works out as follows :—

Traffic area = 652 squar miles.

Total probable imports = $652 \times 33\frac{1}{2} = 21,842$ tons.

Mean lead = 26 miles.

Ton miles = $21,842 \times 26 = 5,67,892$ ton miles.

	Rs.
Freight at Re. 0-0-9 per ton mile	= 26,620
Terminal charges at Rs. 1-1-0 per ton	= 27,303
Total import freight earnings	= 53,923
Import freight earnings per mile per week	Rs. 17
Average lead (same as for exports)	Miles 26
Average import per capita	Ton 0.22
Average earning per capital	Re. 0.55

29. *Through traffic.*—Neither the Great Indian Peninsula nor the Bombay, Baroda and Central India Railways have been able to give me figures of the probable traffic which would be diverted from the present routes *via* the new line. (*Vide* Appendix III). But as the Neemuch-Pachpahar chord will shorten the lead from Agra and Cawnpore by something like 90 miles for Neemuch and stations south of it on the Malwa section up to Rutlam, I think an average of four wagons a day is not too high an average to take say 40 tons daily. We have then :—

Annual through traffic, $40 \times 305 = 14,600$ tons.

$14,600 \times 62 = 9,05,200$ tons miles.

Freight at Re. 0-0-9 per ton mile = Rs. 42,431

Say Rs. 42,000 or Rs. 13 per mile per week.

30. *Abstract of probable gross earnings :—*

	Rs.
Coaching	1,20,000
Exports	75,717
Imports	53,923
Through traffic	42,000
Total gross earnings	2,91,640
	say Rs. 2,92,000
Total gross per mile per week Rs	91

31. *Comparison with gross earnings of adjacent sections of existing railways :—*

Railways.	Length.	Gross earnings.		Per Capita.
		Per mile per week.	Total.	
		Rs.	Rs.	Rs.
Neemuch-Pachpahar	62	91	2,92,000	2.8
Nagda-Muttra	77	160	6,43,967	4.9
Malwa section	62	267	8,48,057	3.5

32. Working expenses:—

Daily load—

898 passengers at 0.5 ton each	tons 449
184 tons goods at 2.5 tons per ton freight	„ 460
Total load daily = Tons	909 say 900

Roughly 3 “F” class engine loads on a 1 in 200 ruling grade,

Train mileage, daily $3 \times 62 = 186$ train miles.

Yearly $186 \times 365 = 67,890$ miles, say 67,900.

Fixed expenses—

Engineering.	Rs.
General charges	
500 × 62 =	31,000
300 × 62 =	18,600

Expenses varying directly with train mileage—

Locomotive	Rs.
Carriage and wagon	
67,900 × annas 12 =	50,925
67,900 × „ 1.5 =	6,366

Traffic, all items except station staff,

$67,900 \times \text{annas } 2 = \text{Rs. } 6,488$

Station staff, 5 third class stations at Rs. 1,800 each	= 9,000
Extra at termini	2,000
Transhipment 60,000 tons at annas 2 per ton.	7,500
Total traffic expenses	Rs. 26,988 say 27,000

Abstract of working expenses:—

Fixed expenses—

Maintenance	Rs.
General charges	
31,000	
18,600	
	Rs. 49,600

Variable expenses—

Locomotive	50,925
Carriage and wagon	6,366
Traffic	27,000
Total working expenses	Rs. 84,291 say 1,34,000

Cost per train mile = Rs. 1.97, say Rs. 2 per train mile.

Proportion of gross earnings 46 per cent.

33. Probable net earnings:—

Estimated gross earnings	Rs.
Estimated working expenses	
2,92,000	
1,34,000	
Probable net earnings	1,58,000

34. Dividend prospects:—

Estimated capital outlay	Rs.
Estimated net earnings.	
42,38,150	
1,58,000	

presenting interest on capital at the rate of 3.7 per cent., say, 4 per cent.

35. *Competition with existing lines.*—The line will not be in competition with existing railways, on the contrary it will act as a powerful feeder. It will, no doubt, shorten the lead for goods from Agra and Cawnpore, but this

loss in extra mileage will be more than made good by the extra traffic handled. It is presumed that the line will be worked by the Bombay, Baroda and Central India Railway.

36. *Length of line in each Native State.*—The line from Neemuch to Pachpahar passes through the States of Gwalior, Indore and Jhalawar. The length of line in each is:—

Gwalior 16·12 miles.

Indore 42·13 miles.

Jhalawar 3·25 miles.

37. *Advantage of the line from the point of view of economic development.*—The construction of the Neemuch-Pachpahar Railway will fill a long felt want. The line will very soon attain the same prosperity as that of the Malwa section of the Bombay, Baroda and Central India Railway, following on the very rapid development of the country which it will serve. Manassa and Rampura will regain some of their lost importance. It is a scheme which should appeal to the progressive Darbars of Gwalior and Indore. Besides being a sound investment within their own State, it is an improvement which will bring general prosperity to a very large district, a prosperity in which the States will share in the shape of increased revenues.

NEEMUCH-PACHPAHAR-CHHABRA.

PART II.

PACHPAHAR TO JHALRAPATAN.

GAUGE—5'—6" (Light Broad Gauge.)

Length 26·00 miles.

Length of line in each Native State.

Gwalior	.	.	.	.	.	.	.	.	5·75 miles.
Jhalawar	.	.	.	.	.	.	.	.	20·25 „
									Rs.
Total cost	.	.	.	.	.	.	.	.	26,52,000
Cost per mile	.	.	.	.	.	.	.	.	1,02,000

Percentage of net earnings on total capital outlay 5 per cent.

NEEMUCH-PACHPAHAR-CHHABRA.

PART II.

PACHPAHAR TO JHALRAPATAN.

GAUGE—5' 6" (Light Broad Gauge).

Length 26·00 miles.

	Rs.
Total cost	26,52,000
Cost per mile	1,02,000

1. *Preliminary.*—This section of the project is the second part of the proposed chord from Neemuch to Chhabra. It is dealt with separately here, as it is an important section, on its own merits, and its construction as a branch line, for the time being, might be considered.

2. *Gauge.*—The gauge selected for this section and its extension to Chhabra, is the broad or 5'—6" gauge, laid with 60 lbs. B. S. S., F. F. rails. The reason for selecting the light broad gauge is one of economy and uniformity. The line is to connect two broad gauge systems, and the traffic offering will be amply served by a light broad gauge for many years to come. It is not until the railway from Baran to Jharsi is built, that there will be any large through traffic. It will only then be a case of relaying the line with a heavier permanent way, as everything else is to standard broad gauge. Meanwhile, a saving of Rs. 13,00,000 is affected, and the initial outlay kept as low as possible, without impairing the efficiency of the infant line.

3. *Fixed points.*—The "fixed points," from which the mileage is reckoned, is the centre of Pachpahar station. The mileage from Neemuch has not been carried through to Chhabra.

4. *Length of line.*—The line from Pachpahar to Jhalrapatan is 26 miles in length.

5. *Gradients and curves.*—The ruling grade will be 1 in 200. There will be no sharp curves.

6. *Location.*—The alignment selected branches off the Nagda-Muttra Railway, 2 miles north of the centre of Pachpahar station. Proceeding north-east, the line makes for the watershed separating the Rewa and Au rivers. It follows it to mile 15 when, turning almost due east, it crosses the Au river by a proposed bridge of 20 spans of 50 feet arches. Then it resumes its original direction up to mile 24 where, turning south-east at the foot of the Mukandwara hills it reaches the station of Jhalrapatan at mile 26·00.

The reason for approaching the city of Jhalrapatan by the north is to avoid the low land south of the city, and also to keep above the artificial lake of Patan and Mundelkheri, and their waste weirs for which an extra bridge would have to be provided for. The site selected for the station is quite a satisfactory one, and meets with general approval locally. It is within half a mile of Patan, the local name for Jhalrapatan city, and $3\frac{1}{2}$ miles by a very good metalled road from Jhalrapatan Chaoni, the official capital of Jhalawar. The site is at the foot of the western arm of the Mukandwara hills which contain quarries of sandstone of excellent quality; it is also on the shores of the Patan lake, which will supply good and perennial water.

The country between Pachpahar and Jhalrapatan is an extension of the fertile Malwa plateau, with slightly more accentuated undulations. It falls gently and continuously from a level of 1250 at Pachpahar to 1040 at Jhalrapatan. The country traversed is well cultivated, and the gaily coloured poppy patches and azure blue of the linseed add a delightful touch of colour to the emerald sea of cornfields.

7. *Alternative routes.*—If the main object of the line, as I understand it, is to foster the economic development of the country, then there is no question

about it, Jhalrapatan, which is the largest and most important town in the whole area under survey, is an objective, and the route selected on the watershed the cheapest. One of the alternatives of the survey of 1893 approached the city of Jhalrapatan by the south. This route is now closed by the construction of the Mundelkheri reservoir.

The alternative suggested by the Indore Darbar for a direct line from Pachpahar to the Baran-Bina Railway *via* Sunel, Raipur and Arnia is entirely one-sided. It will leave Jhalrapatan 13 miles off the main line. There is nothing to recommend that alignment, except that it is 9 miles shorter for a through line to Chhabra. That route would defeat the very object of the proposed railway; it would leave out the most populous and important trade centre, to pass through Sunel and Raipur, two unimportant places compared with Jhalrapatan. Jhalrapatan, (Patan and the Chaoni) has a population of 22,000 souls and together with the neighbouring villages, the station will serve over 35,000 people. Sunel is only a large village with 3,700 inhabitants, and Raipur is of about the same size. Unless the main railway passes within easy access of Jhalrapatan, the railway will lose the extra lead on the traffic of Jhalrapatan. The railway will not be able to compete with the motor service, and the traffic of Jhalrapatan will continue to come and go *via* Shri-Chhatrapur; further sooner or later a broad gauge line will have to be built to Jhalrapatan to meet the demand of its industries.

If we give a monetary value to the disadvantages of each route, we have, roughly.

(i) Alternative *via* Sunel, Raipur and Arnia.

Loss of say only half the Jhalrapatan traffic, say Rs. 50,000 per annum.

Capitalize this loss at 4 per cent. per annum = Rs. 20,00,000.

(ii) Alternative *via* Jhalrapatan.

Extra length, 9 miles (earthwork, minor bridges and permanent way only),

$9 \times \text{Rs. } 64,000 = \text{Rs. } 5,76,000.$

Working expenses over extra length at Rs. 2 per train mile for two trains a day,

$9 \times 2 \times 365 = \text{Rs. } 6,570 \text{ train mile per annum.}$

$6,570 \times 2 = \text{Rs. } 13,140.$

Capitalize this sum at 4 per cent per annum = Rs. 3,26,500.

The total rough value of (ii) is Rs. 9,02,500 against Rs. 20,00,000 of (i). So that from the economic development as well as from the traffic and financial points of view, the alignment *via* Jhalrapatan is the correct one.

8. *Construction and engineering.—Earthwork.*—The formation has been estimated for full standard section for both banks and cuttings. The earthwork is light and amounts to an average of 5 feet of bank.

Bridges.—The only important bridge is the one over Au river. It consists of 20 spans of 50 feet arches. Rock foundation will be easily reached at a shallow depth. Good lime and sandstone are available from the Jhalrapatan quarries. For the rest of the line, the bridging is light and amounts to only 25 feet of waterway per mile, exclusive of that over the Au river.

Permanent way.—The permanent way, proposed for adoption, consists of B S. S., F. F. rails, 60 lbs. per yard on half round of Jodka sleepers. The ballast will be of stone.

Platforms.—Rail level passenger platforms 600 feet long by 25 feet wide. No raised goods platforms. At Jhalrapatan, a high level passenger platform with a motor ramp at one end has been estimated for.

Stations and buildings.—All stations have been estimated for minimum equipment necessary to deal with the traffic in sight.

Water supply.—Jhalrapatan will be a watering station; water will be pumped from the Patan lake close by.

Rolling stock.—Sufficient rolling stock to meet the probable traffic during the first three years has been estimated for.

General charges.—The provision made is to cover the cost of establishment required to complete the branch line within two years from date of commencing building operations.

Junction arrangements.—Liberal allowances has been made for junction requirements at Pachpahar, as a supplement to what has already been provided for the Neemuch-Pachpahar section.

Rates.—The same rate as for the Neemuch-Pachpahar section have been assumed.

9. *Rough estimate of the cost of construction.*—The probable cost of constructing the Pachpahar-Jhalrapatan section of the light broad gauge chord from Pachpahar to Ohhabra is Rs. 26,52,000 or Rs. 1,02,000 per mile.

10. *Abstract of rough estimate of the cost of construction of the Pachpahar Jhalrapatan section.*

Light broad gauge, 26 miles long.

Main heads.	Total by main heads.	Rate per mile.	REMARKS.
	Rs.	Rs.	
I.—Preliminary expenses	15,600	600	Compensation only.
II.—Land	20,000	1,000	
III.—Formation	2,31,000	9,000	
IV.—Bridge Work	4,29,000	16,500	
V.—Fencing, etc.	23,800	800	
VI.—Electric telegraph . . . . .	...	...
VII.—Ballast and permanent way	12,81,800	49,300	
VIII.—Stations and buildings	78,000	3,000	
IX.—Plant	28,000	1,000	
X.—Ferrica . . . . .	...	...
XI.—Rolling stock	4,36,800	16,800	
XII.—General charges	1,01,000	4,000	
TOTAL	26,52,000	1,02,000	

TRAFFIC AND DIVIDEND PROSPECTS.

11. *General remarks.*—The surplus produce of the area to be served by the proposed branch line goes almost entirely to the "Mandi" at Pachpahar, while most of the imports of Patan come *via* Shri Ohhatrapur. The expected earnings can be fairly accurately gauged. From various informations collected, I come to the conclusion that one quarter of the earnings of Pachpahar station and three quarter of the earnings of Shri Ohhatrapur station are from the country to be served by the proposed railway.

12. *Existing means of transport.*—Bullock carts and pack animals carry the goods traffic; and carts, tongas and a motor service carry the passengers. The motor service plies from Patna *via* the Chaoni to Shri Ohhatrapur station. The cars carry 20 passengers each, and make two trips a day. The run from

Patan to Shri Chhatrapur takes a little over 1½ hours. The single fare is Re. 1 per passenger. The tongas charge 12 annas per seat and carry three persons. The cars are unable to cope with the passenger traffic and some 50 or 60 people have to use carts and tongas. Communication between Jhalrapatan and Pachpahar is entirely by tongas and carts.

13. *Markets*.—Almost all the "entrepôt" trade of the wide belt of tributary territory of the Nagda-Muttra Railway, east of the Mukandwara hills, is carried by Pachpahar (Bhawaniganj) "mandi." Before the advent of the railway that trade was done by Patan, but since the construction of the Nagda-Muttra the trade is gone to the new mandi of Bhawaniganj at Pachpahar station.

Patan is mainly the distributing centre of imports for the Ohaoni and surrounding villages. It is well connected by roads to all the surrounding States and with the advent of the railway will recover its old importance.

14. *Stations*.—Only one intermediate station, Ganeshpura, has been provided midway between Pachpahar and Jhalrapatan. It is situated along the road to Sunel, eight miles away. It will serve the track of country between the Rewa and Au rivers.

Jhalrapatan station will serve over 35,000 people. The city of Patan is the home of many wealthy Seths and Bhoras who wish to start several industries near their home. The two industries they are most keen on, are cotton spinning and weaving, and lime and cement manufacture. The machinery for the cotton mill has already been ordered from England. The cement and lime factory will be started as soon as the alignment of the railway has been settled.

Amongst many interesting old buildings, Jhalrapatan contains two very fine temples. One of which, the Chandravati temple, dates back to the VII century.

It is a place of pilgrimage and is yearly visited by about 20,000 pilgrims.

Jhalrapatan will make a good terminus for the feeder railways to Ujjain and Salamatpur.

15. *Fairs*.—Two fairs are held annually at Patan. They are popular in the neighbourhood and are attended by at least 20,000 people each. Besides being pilgrimages they are also cattle fairs, and at the last one over 12,500 cattle were sold, and over 600 sent by the railway from Pachpahar and Shri Chhatrapur. Many cloth and other merchants come to these fairs and do a good trade. The first fair takes place in April, and the second in November. An earning of Re. 1 per head can confidently be expected on at least 10,000 pilgrims at each fair. I am told that if wagons are supplied, over 1,000 cattle would be exported by rail to Gujarat, Marwar and Kathiawar at each fair.

16. *Prospective traffic*.—By prospective traffic, I mean that latent traffic which entirely depends on the advent of the railway to develop. Of those there is the stone traffic which will be very remunerative to the railway. The stone is popular under the name of Indore stone and is in great demand, but can only be exported in small pieces at present. At least 10 tons or one wagon load will be exported daily to station beyond Pachpahar to start with, and three or four wagons daily to Pachpahar for local use.

For the manufacture of lime and cement, 30 tons of coal will be required daily, and the promoters of the company expect to export no less than 3,000 maunds of lime and cement daily.

There will also be the requirements of, and the exports from, the cotton mill but I am leaving those out, as unless the construction of the line to Jhalrapatan is begun very soon the mill will be erected at Pachpahar.

17. *Jhalrapatan quarries*.—The Jhalawar quarries consists of sandstone and limestone. The latter are used chiefly for manufacture of lime and are little used for building purposes. The sandstone is of excellent quality and is largely used for building purposes. There are two kinds of sandstone; the white and terra cotta. The white stone is hard and varies in texture from coarse to very fine grain. In the old palace and other buildings in Patan and the

Ohaoni, beams of 24 and 31 feet in length are to be seen either spanning roofs or used as girders across the moat. The terra cotta stone, commonly known as Indore stone, is softer and is mostly used for ornamental work like carved columns or for the fretwork used in the screens shielding from view the women's apartments or for railing of verandahs, etc. It also provides slabs largely used for roofing and floors. In the palace at the Ohaoni, slabs from 20 to 24 feet are commonly used for floors and roofs; these slabs taking the place of girders as well. Roofs of most of the houses are made of these slabs, but of less ambitious dimensions.

The quarries worked at present are all situated in the western arm of the Mukandwara hills. The most famous quarries are Binjari, Ralaita, Samadkheri and Bagdor. They will all be close to the proposed railway and can easily be served either directly from the main line or by sidings.

The stone costs 2 annas per cubic foot at the quarry. It weighs from 112 to 120 lbs. to the cubic foot, and so no piece beyond 8 cubic feet can at present be carted to any great distance. This stone will be largely exported to Indore, Gujarat and Ahmedabad. It will also be in great demand in the growing town of Pachpahar and up the Nagda-Muttra.

The limestone has been analysed and very favourably reported on for the manufacture of lime and cement on a large scale. (Appendix VI).

18. Gross earnings.—

(a) (PASSENGER TRAFFIC.)

Estimated passenger traffic, and immediate gross coaching earnings.

Stations.	Population served.	Daily No. of passengers.	Distance for charge.	Daily passenger.	Rate.	EARNINGS.	
						Daily.	Annual.
	No.		Miles.	Miles		Rs.	Rs.
Pachpahar . . .	...	...	...	...	3 pies per passenger per mile.	...	...
Ganeshpara . . .	14,000	60	18	780		12	4,390
Jhalrapatan . . .	86,300	300	28	7,800		122	44,530
Total . . .	49,300	360	...	8,580		124	48,910

Estimated gross coaching earnings Say Rs. 49,000

Total per mile per week " 36

Average passenger lead Miles 24

Average earnings per capita Rs. 0.98

Average number of trips per capita Trips 2.6

19. *Check on passenger traffic.*—As mentioned in paragraph 11, one quarter of the earnings of Pachpahar station, and three quarters of the earnings of Shri Chhatrapur station are derived from the area to be served by the proposed branch from Pachpahar to Jhalrapatan. That applies to goods as well as to coaching traffic. So that, the immediate coaching earnings of the proposed branch, without the prospective additions due to the contemplated development of local industries and the construction of feeder railways to Salamampur and Ujjain should be about as follows :—

	Rs.
Pachpahar, gross coaching earnings Rs. $\frac{72,108}{4}$	= 18,027
Shri Chhatrapur gross coaching earnings Rs. $18,028 \times \frac{3}{4}$	= 36,703
Total	<u>54,730</u>

20. (b) GOODS TRAFFIC.

Exports.

Stations.	Population served.	Export.	Distance for charge	Maund miles.	Rate.	Earnings per annum.
		Mds.	Miles.			Rs.
Pachpahar . . . . .	...	...	...	...	3 pie per maund mile 21/4 9 pies per maund terminal charge.	...
Ganeshpura	14,000	14,400	13	1,67,200		1,000
Jhalrapatan	35,800	33,400	26	21,63,400		7,672
Total	49,800	97,800	...	23,55,600		8,672

Imports.

Stations.	Population served.	Export	Distance for charge	Maund miles	Rate.	Earnings per annum
		Mds.	Miles.			Rs.
Pachpahar . . . . .	...	...	...	...	3 pie per maund mile 21/4 9 pies per maund terminal charge.	...
Ganeshpura	14,000	38,000	13	4,29,000		2,292
Jhalrapatan	35,800	1,05,900	26	27,63,400		9,742
Total	49,800	1,38,900	...	31,82,400		12,035

Subsidiary traffic.

Fairs—

$$2 \times 10,000 \times \text{Rs. } 1 = \text{Rs. } 20,000.$$

Cattle—

$$2,000 \times \text{Rs. } 5-11-0 \text{ each} = \text{Rs. } 11,375.$$

Stone export—

At 4 wagons daily, say 15,000 tons per annum.

$$15,000 \times \text{Rs. } 1-3-0 = \text{Rs. } 17,813.$$

Prospective traffic.

Traffic which may confidently be expected within three years of opening the line.

	Tons.
Lime and cement export	100 daily.
Coal for manufacture	30 „
Total	130 „
47,450 annually	

Rs.

$$47,450 \text{ tons at Rs. } 1-3-0 \text{ per ton} = \text{Rs. } 56,847$$

The traffic to be expected from the cotton mill will be small for some time and may be left out here.

21. *Total goods earnings.*—

	Rs.
Exports	8,673
Imports	12,035
Fairs	20,000
Cattle export	11,875
Stone export	17,813
Lime and cement	56,347
Total	1,26,248
Say	1,26,000
Goods earnings per mile per week	93

22. *Total gross earnings.*—

	Rs.
Coaching	49,000
Goods	1,26,000
Total	1,75,000
Gross earnings per mile per week	129

23. *Working expenses.*—The load to be hauled daily is:—

	Tons.
Passengers 360 at 0.5 ton per passenger	180
Goods, 200 tons at 2.5 tons load per ton freight	500
Total gross load	680

For a light broad gauge, I roughly calculate the maximum load on a gradient of 1 in 200, to be 400 tons gross; so that two trains a day will be enough to deal with the traffic offering.

Daily mileage = $2 \times 26 = 52$ train miles.

Yearly mileage = 18,980 train miles.

Add extra for fairs and cattle export, 520 train miles.

Total yearly train mileage = 19,500 train miles.

Fixed expenses—

	Rs.
Engineering maintenance, 26×364	9,464
General charges 26×300	7,860
Total	17,264

Variable expenses—

Locomotive—19,500 train miles at Rs 0.75	14,625
Carriage and wagon, 19,500 train miles at $1\frac{1}{4}$ anna per train mile.	1,828
Traffic—All items except station staff 19,500 train miles at annas 2.	2,438
Station staff.—One station at Rs. 1,800 each	1,800
Terminals 2 at 2,500 each	5,000
Total	25,691

Abstract of working expenses—

Fixed expenses	17,264
Variable expenses	25,691
Total	42,955

Total working expenses, say Rs. 43,000.

Cost per train mile, Rs. 2-2.

24. *Estimated net earnings—*

	Rs.
Estimated gross earnings	1,75,000
Estimated working expenses	43,000
Estimated net earnings	<u>1,32,000</u>

Net earnings per mile per week Rs. 98.

25. *Dividend prospects—*

Estimated capital outlay	20,52,000
Estimated net earnings	1,32,000
Interest on capital	5 per cent.

26. *Diversion of traffic.*—There is no doubt that on the opening of a branch line from Pachpahar to Jhalrapatan, the earnings of both Pachpahar and Shri Chhatrapur stations will be considerably reduced, but there will be no loss to the parent line. On the contrary, there will be the earnings on an extra average 18 miles lead, and also the benefit of the extra traffic which under present transport difficulties cannot develop.

NEEMUCH-PACHPAHAR-CHHABRA.

PART III.

JHALRAPATAN TO CHHABRA.

Gauge :—5' 6". (Light Broad Gauge).

Length—60 Miles.

Total cost Rs. 63,26,000.

Cost per mile Rs. 1,05,600.

NEEMUOH-PACHPAHAR-CHHABRA.

PART III.

Jhalrapatan to Chhabra.

Gauge :—5' 6". (Light Broad Gauge).

Length 60 Miles

Total cost Rs. 63,36,000.

Cost per Mile Rs. 1,05,600.

1. *Preliminary.*—This final section of the through east and west connection is the extension of the light broad gauge line proposed from Pachpahar to Jhalrapatan. Its main object, as I understand it, is not to short circuit the Baran-Bina and Nagda-Muttra Railways. It is to serve the land locked tracts within the Mukandwara and Shergarh hills, which at present are badly off for communications.

2. *Gauge.*—Light Broad Gauge.

3. *Fixed Point.*—The mileage of the Pachpahar-Jhalrapatan line has been carried through to Chhabra.

4. *Length of Line.*—The Line is about 60 miles long. It passes through the Native States of Jhalawar, Kotah and Tonk. The length in each State is as follows :—

Jhalawar	.	.	.	.	.	.	.	.	.	55 miles.
Kotah	.	.	.	.	.	.	.	.	.	46.75 "
Tonk	.	.	.	.	.	.	.	.	.	4.50 "

5. *Gradients and curves.*—The ruling grade is 1 in 100 or 1 per cent. There will be no economy in the use of sharp curves.

6. *Location.*—Immediately after leaving Jhalrapatan, the line enters difficult country for railway construction. Not only on account of the hills it has to cross, but also on account of the big rivers met with and the numerous cross drainage. The rivers often flood the surrounding country in their valley and so, fairly high banks are required across them.

Leaving Jhalrapatan station at a level of 1010 and following the western talus of the southern arm of the Mukandwara hills, the line crosses the Chandrabagha river at mile 27½ and the Kali Sind river at mile 32. Then, passing through a convenient gap in the hills at mile 33½ north of Richwan, it makes for Asnaur, crossing the Ujar river at mile 39. From mile 41, the ascent of the hills separating the Aklera basin from the Malwa plateau begins. The general altitude of the Malwa plain and that of the Aklera basin is very nearly the same, roughly 1,000 feet above M. S. level. The lowest place on the crest of the hills separating them is at mile 45.5 and it is 1,200 feet above M. S. L. The hills are 4 miles wide at the base and offer very little ground for development. By the alignment selected, which is too direct, this 400 feet of rise and fall is overcome by a 1 per cent. grade with a cutting about a mile long, and 87 feet maximum depth at the summit. A detail survey with contours will no doubt reduce the cutting a good deal but I doubt whether the 1 per cent. grade will be eliminated on that route. The crossing of the Aklera basin is easy and up to mile 60, the location requires no comment.

To make for Goona or Rothia from the Aklera basin is not practicable. The nearest place on the Baran-Bina Railway where a junction can be effected is at Chhabra—Even then, a lengthy detour is necessary to climb the 300 feet rise to the summit of the Shergarh hills and to effect the 100 feet descent from there to the Chhippa Barod plain.—This involves no difficult work, but the line runs across a heavy drainage. Once in the plains of Chhippa Barod the line through easy country proceeds to Chhabra.

The hills met with are mostly of sand stone and are remarkable for their precipitous sides and lack of supporting ground. Besides the Chandrabagha the Kali Sind and the Ujar rivers previously mentioned the following important rivers are crossed :—The Ghar at mile 50, the Parwan below its confluence with the Newaj at mile 57 and the Andheri at mile 81½.

7. *Alternative routes.*—Several alternative routes from Jhalrapatan to Chhabra exist.—

1. *Via* the Mandawar Pass and Sarola
2. *Via* the Mau Pass and Sarola.
3. More or less along the route selected, but leaving Asnaur out of the way, crosses the first range of hills at mile 45 in the neighbourhood of Ameta and then back again to the route selected.

The route *via* Mandawar is in my opinion not easier than the one selected and it defeats the object of the line which is to serve the fertile but land locked basin of Aklera.—It affords a bad crossing of the Kali Sind; the bridge on that alignment will be over 100 feet high and a very high bank will be required across the flooded valley of the Kali Sind—The cutting at Mundawar will be over 80 feet maximum depth and extend more or less over 3 miles.

Alternative 2 leads to an expensive tunnel.

Alternative 3 is well worth trying again—a short tunnel about ¼ mile long will be required at mile 45 but then all the heavy work will be concentrated at one place and the 1 per cent. grade might be eliminated.

8. *Junctions.*—Chhabra Station, the proposed junction on the Baran-Bina Railway is at mile 717 from Bombay along the Great Indian Peninsula Railway and only 651 miles *via* Baran and Kotah along the Bombay, Baroda and Central India Railway. By the new line and the Bombay, Baroda and Central India Railway it will only be 598 miles from Bombay.

Chhabra is already an Engine watering station and the headquarters of a permanent-way inspector. Very little will be wanted at Chhabra in the way of engine shed etc., to begin with, as the same train which will come in from Pachpahar in the morning will return to Pachpahar in the afternoon and stable there.

Pachpahar, the other terminus of the light broad gauge line, will be fully equipped and provision for this had been included in the estimates given in Part I and II of this report.

9. *Construction and Engineering.*—The extension from Jhalrapatan to Chhabra will be built and equipped to the same standard as the Pachpahar-Jhalrapatan line previously described.

The important bridges are :—*viz.*

1. Chandrabagha mile 27½ 7 × 60 ft. Girders.
2. Kali Sind mile 32 7 × 100 ft. Girders.
3. Ujar mile 39 10 × 60 ft. Girders.
4. Ghar mile 50 8 × 60 ft. Girders.
5. Parwan-mile 57 9 × 100 ft. Girders.
6. Andheri mile 81½ 6 × 60 ft. Girders.

The total waterway averages 90 ft per mile.

10. *Rough estimate of the cost of construction.*—The probable cost of construction the Jhalrapatan-Chhabra section of the Pachpahar-Jhalrapatan Chhabra Railway is Rs. 63,36,000 or Rs. 1,05,600 per mile.

11. *Abstract of the probable cost of Construction.—Length 60 miles.*

Main heads.	Total by main heads.	Rate per mile.	REMARKS.
	Rs.	Rs.	
I. Preliminary Expenses	36,000	600	
II. Land . . . . .	...	...
III. Formation	7,92,000	13,200	
IV Bridge work	14,40,000	24,000	
V. Fencing, etc.	80,000	500	
VI. Electric Telegraph . . . . .	...	...
VII. Ballast and Permanent Way	29,58,000	49,300	
VIII. Stations and Buildings	1,80,000	3,000	
IX. Plant	60,000	1,000	
X. Ferries . . . . .	...	...
XI. Rolling Stock	6,00,000	10,000	
XII. General Charges	2,40,000	4,000	
Total	68,80,000	1,05,600	

TRAFFIC AND DIVIDEND PROSPECTS.

12. *General Remarks.*—Most of the traffic of Aklera goes *via* Jhalapatan either to and from Pachpahar, Morak and Suket; all three being stations on the Nagda-Muttra Railway. The Basin of Aklera is fertile and well cultivated. Aklera is the headquarters of a Nizamat of Kotah State

If the line is extended to Chhabra not only will the traffic of Aklera use the new line but that of Sarola, Khanpur and Manohar Thana. It is more than probable that a "Mandi" would start at Aklera extending its business to beyond Kilchipur and Rajgarh.

Though there are several good fair weather Roads connecting Aklera and the neighbourhood to the pucca roads of Jhalawar and Kotah. These Roads are impassable in the rains on account of the black cotton soil and from June to October that area is almost isolated.

The new line will also offer a shorter Route to the traffic for Bombay and Gujrat from stations on the Baran Bina Railway between Chhabra and Atru. Transport at present consists of pack animals and bullock carts. It is both scarce and expensive and cannot be used in the rains.

13. *Stations.*—The position of stations was not carefully looked into on this extension, but the following are the main places along the line.

Asnaur, mile 29.—That station will serve all the area on the East of the Kali Sind valley.

Aklara, mile 55—Headquarters of a Nizamat of the Kotah State, the proposed terminus of the Baran-Aklara and Aklara-Manohar Thana feeder Railways. It is the centre of a grain producing area and a station there will serve as far as Khanpur on the North and as far as Manohar-Thana on the South.

Saitbal, mile 60 —The largest place on the extension —It will serve the big villages lying on the East of the Parwan River.

Ohhippa Barod, mile 74.—A large village in Kotah State situated in a wide and well cultivated plain.

14. *Gross Earnings.*—(a) Coaching earnings. The coaching earnings per capita may be taken as the same as the one for the section from Pachpahar to Jhalrapatan. If anything it should be a little more on account of the longer lead.

The traffic area is 300 Sq. miles, and the population averages 100 to the square mile.

$$300 \times 100 = 30,000.$$

$$30,000 \text{ at Re. 1, Rs. } 30,000$$

The through passenger traffic will be small and may be neglected.

15 (b) *Goods Earnings Imports.*—The only figures I have to guide me are the State Revenue figures which are distinctly low *viz.*, 0.1 ton per capita per annum. However owing to difficulties of transport I don't think the figure is so very much out and it will give us a very conservative estimate. Making up for any error in the opposite direction for the Exports. Most of the Imports come from Bombay and Gujrat. The extension is given the benefit of the lead to Pachpahar. The traffic to and from the proposed Feeder Railways is not taken into account:—

Stations.	Population served.	Imports.	Distance for charge.	Ton miles.	Rate.	Earnings.
	No.	Tons.	Miles.			Rs.
Jhalrapatan . . . . .	...	...	...	...	9 pias per ton mile plus Re. 1.25 per ton terminal charge.	...
Amsur	4,000	400	39	15,600		1,231
Aklara	18,000	1,800	55	82,500		5,742
Barthal	5,000	500	60	30,000		2,031
Chippa Barod	6,000	600	74	44,400		2,891
Chhabra . . . . .	...	...	...	...		...
Total	30,000	3,300	...	1,72,500		11,835 Say, 12,000

Average lead—57.5 miles.

Earning per capita—Rs. 0.39.

16. Estimate of Exports, based on the yield per acre within expected Traffic Area.

Stations.	Mileage.	Traffic Area.	Population per Square mile.	No of Square miles under Cultivation.	Average yield in mannds per acre.	Total yield per Square mile of Traffic area.	Consumption at 8 lbs. per head per day in tons per Square miles.	Balance available for Export per Square mile.*	Total available for Export and interstation traffic.	Ton miles.	Rate.	Earnings.
		Square miles.	No.	Square miles.	Mannds.	Tons.	Tons.	Tons.	Tons.	Tons.	9 lbs per ton mile plus Rs. 1-3 per ton terminal charges.	
Jhalrapatan	26	...	...	...	...	...	...	...	...	...	...	...
Asnagar	39	40	100	30	6	105	50	55	2,220	42,900		3,315
Aklara	55	150	100	120	8	165	50	115	17,250	4,71,375		33,017
Serthal	60	50	100	30	8	133	50	83	4,150	1,21,500		8,430
Chhipra Barod	74	60	100	45	8	108	50	53	3,450	1,23,750		18,210
Chhabra	88	...	100	...	...	...	...	...	...	...		...
Totals . . . . .	...	300	30,000	...	...	...	...	...	27,080	7,70,535	...	53,043 Say 53,000

Average land Miles 57
Average Export per Capita Ton 0.13.
Average Earning per Capita Rs. 1.7.

*NOTE.—It is assumed that half the surplus produce will use the Railway.
The Traffic, likely to come in from the feeder Railway, has not been included.

17. *Through Traffic*.—The Traffic Manager, Great Indian Peninsula does not expect that very much Traffic will be diverted from existing Routes *via* the Pachpahar-Chhabra line, but I think at least $\frac{1}{2}$ a wagon load a day will on an average come from the Baran-Bina Section and on this assumption I estimate the through traffic at:—

365 x say 5 ton	. . . . .	1,825	tons yearly.
say	. . . . .	1,800	tons.
1800 x 86	. . . . .	1,54,800	ton miles.
		Rs.	
at 9 pies per ton mile.	. . . . .	7,250	
say	. . . . .	7,000	

18. *Abstract of Probable Gross Earnings*:—

Coaching.	. . . . .	30,000
Imports	. . . . .	12,000
Exports	. . . . .	58,000
Through Traffic	. . . . .	7,000
Total Gross Earnings	. . . . .	1,02,000
Total Gross per mile per week	. . . . .	33

19. *Working expenses*.—Owing to the 1 per cent. grade, the working expenses will be heavier than on the first section from Pachpahar to Jhalrapatan and so if we take the working expenses at Rs. 2.5 per train mile instead of Rs. 2.2 we have for one train a day each way which is enough for the traffic estimated.

Train mileage—yearly:—

		Rs.
2 x 60 x 365	. . . . .	43,800 train miles.
43,800 x 2.5	. . . . .	1,09,500
Total working expense	. . . . .	1,09,500

20. *Estimated Net Earnings*:—

Estimated Gross Earnings	. . . . .	1,02,000
Estimated working Expenses	. . . . .	1,09,500
Net Loss	. . . . .	7,500

21. *Financial Results*.—The extension to Chhabra on even a light broad gauge will prove a dead loss. This result may perhaps be due to a too conservative estimate, but I doubt it. The country is thinly populated, *viz.*, only 100 per square mile. People have migrated to less land locked areas.

NEEMUCH-PACHPAHAR-CHEHABRA.

PART IV.

Feeder Railways.

Gauge 2' 6".

Total Length 386·3 miles.

Gauge 2' 6".

	Length miles.
(i) Baran to Etawah	30·5
(ii) Baran to Aklera (with a Branch to Sangod)	62·5
(iii) Aklera to Manohar Thana	19·5
(iv) Jhalrapatan to Salamatpur	136·8
Branch Barasia to Sironj	38·0
(v) Jhalrapatan to Ujjain	99·0

PART IV.

Feeder Railways.

1. *General Remarks.*—As stated in paragraph 30, all that is necessary to serve the internal communications and purely local traffic, is some cheap saving device in time labour and money. The cultivator wants to be left to till the fields instead to have to cart his produce to distant markets. The "beparis," brokers and other commercial agents want to move quickly about the various trade centres buying and selling. The quantity of goods and passengers to be moved about the various local centres is small, so that efficient motor transport or cheap, but well built, tramways is all that is required. Motor transport will not be as efficient and as cheap as the tramways. With a centrally situated management and workshop, the system of tramways can be built section by section in order of urgency and will soon become a valuable economic asset to the country, while being in itself a financial success. Disjointed units here and there will not pay.

2. *Gauge.*—The gauge proposed for adoption and estimated for is the 2' 6" gauge.

3. *Construction and Engineering :—*

Land.—The land is to be given free by the States concerned.

Formation.—10 feet wide at formation level for banks and 9 feet, exclusive of side drains, for cuttings.

Bridge-work.—Girders to be sparingly used as good building stone is available almost everywhere along the proposed line. The big rivers, which are usually dry for the greater part of the year, to be crossed by dips on to the existing masonry causeways wherever possible. Bridges can be built afterwards, when and where found indispensable.

Fencing.—No fencing necessary. Where the tramway will be contiguous to a road, a hedge may be grown to keep the road traffic away from the tram lines.

Electric Telegraph.—Provision is made for telephones between stations.

Ballast and Permanent Way.—Rails F F. 41½ lbs. steel on half round Jodka teak sleepers, 2,000 per mile. Ballast to be of broken stone, 7 c.ft. per foot run,

Stations and Buildings.—Buildings and equipment to be kept down to absolute minimum necessary to deal with traffic in sight.

Rolling Stock.—Actual requirements for traffic likely to develop within three years of opening the railway.

General and Miscellaneous Charges.—It has been assumed that the tramways in Kotah State would be built by the Kotah Durbar, and that the headquarters of this tramway would be in Baran.

For the other tramways, only one agency has been assumed. The headquarters of that agency can be conveniently situated a Jhalrapatan,

I.—BARAN TO ETAWAH.

Length 30.5 miles; entirely in Kotah State.

4. *Location.*—The country is easy in the extreme, and the location calls for no comment. The alignment suggested by the Kotah Durbar lies east of the Banganga Nadi following the road as far as Mangrol, then crossing the Banganga, it proceeds to Etawah. A cheaper and shorter line is, I think, the one lying on the watershed dividing the tributaries of the Ohambal and Parbati. It is the one selected and marked on the map. The bridging on this alignment, will amount to only 20 lineal feet per mile and the earthwork will also be very light. The detour to take advantage of the road is not justifiable in this case.

The line is entirely in the Kotah State. Leaving Baran, it crosses the Banganga and makes for the watershed which it follows to Etawah. The

country is the fertile, well cultivated and gently rolling plain of Haraoti. It falls very gradually from a level of 864 at Baran to 778 at Etawah. The terminus at Etawah is proposed south of the village, as to cross the Sukri river would lead to an unnecessary expense.

5. *Gradient and curves.*—The ruling gradient is 1 in 200. There are no sharp curves.

6. *Junction.*—The junction at Baran should be kept outside the present Great Indian Peninsula Railway limits to save the expenses of joint working. A broad gauge siding can easily be taken to the feeder railway terminus.

7. *Rough estimate of the cost of construction.*—The probable cost of constructing the line and to equip it fully, as detailed below, works out at Rs. 12,99,300 or Rs. 42,200 per mile.

8. *Abstract of the probable cost of construction.*—(Length 30·5 miles).

Main heads.	Total by main heads.	Rate per mile.	REMARKS.
	Rs.	Rs.	
I.—Preliminary Expenses	9,150	300	
II.—Land . . . . .	...	...
III.—Formation	76,250	2,500	
IV.—Bridgework	1,09,500	3,600	
V.—Fencing, etc.	9,150	300	
VI.—Electric Telegraph	15,250	500	
VII.—Ballast and Permanent-Way	6,40,500	21,000	vide appendix.
VIII.—Stations and Offices	61,000	2,000	
IX.—Plant	12,200	400	
X.—Ferries . . . . .	...	...
XI.—Rolling Stock	3,05,000	10,000	
XII.—General Charges	61,000	2,000	
TOTAL	12,99,300	42,600	

9. *Traffic and dividend prospects.*—The country traversed is very fertile and almost 70 per cent. of it is under cultivation. The main produce is grain and oil seeds which is taken to Baran and Kotah. Owing to numerous and nearly continuous restrictions of booking from Baran to or *via* Kotah, a good deal of the export is taken direct to Kotah by carts. Should the suggestion which I made earlier in this report be carried out, *i.e.*, should the Baran-Kotah be made over to the Bombay, Paroda and Central India Railway, this feeder railway would be a very paying little line and would be of great assistance to the inhabitants.

It is presumed that the tramway will charge slightly higher rates than the railways, and I have taken the following rates for estimating purposes:—

Coaching at $\frac{1}{2}$ annas per passenger mile.

Goods at $1\frac{1}{2}$ annas per ton mile, plus a terminal charge of Re. 1-4-0 per ton.

10. *Gross Earnings.—Coaching.*

Stations.	Population served.	Expected daily No of passengers.	Distance for charge.	Rate.	GROSS EARNINGS.	
					Daily.	Yearly.
Baran . . . . .	...	30	16	1 anna per passenger mile.	16	3,650
Sankli	8,004	80	9		10	5,475
Mangrol	10,752	95	16		32	11,680
Ayana	9,408	60	24		30	10,950
Etawah	13,440	60	29		36	13,140
Total	41,604 say 42,000	325	94	...	129	44,895

Estimated gross coaching earnings	Say Rs. 45,000
Total per mile per week	Ps. 30
Average passenger lead	Miles 18
Average earnings per capita	Re. 1.1

11. *Goods Earnings.—Export.*

The exports are likely to be more than on the adjoining railways because they will not be affected by any restrictions, as the tramway lies entirely in one State. The exports will be from the villages to the towns of either Baran or to Kotah *via* Baran, both within Kotah territory.

The traffic area is fairly well defined. On the west the Chambal river forms one natural boundary and on the east the Banganga is another possible one. Etawah will serve a larger area than the other stations. It will get a good deal of the traffic of Gaiuthia and Karwar and also that of the large tract of rich country to the North of Etawah village.

12. *Estimated Export, based on the yield per acre within the traffic area.*

Stations.	Mileage.	Traffic area.	Population per square mile.	Area under cultivation, cropped & fallow.	Average yield in maunds per acre.	Total yield per square mile of traffic area.	Consumption per square mile.	Balance available for export per square mile.	Proportion expected to use the Tramway.	Total export and inter station traffic.	Ton miles.	Freight charges.	Total export freight earnings.
	Miles.	Square miles.	No.	Square miles.	Maunds.	Tons.	Tons. (a)	Tons.	...	Tons.	...	1.25 annas per ton mile plus No. 1.25 per ton, terminal charge.	Ra.
Baran.	...	...	...	...	...	...	...	...	...	...	...	...	...
Sankli.	9	72	112	63	8	110	60 tons per annum.	80	1/3	2,680	25,920	1.25 annas per ton mile plus No. 1.25 per ton, terminal charge.	5,625
Mangrol.	16	98	112	84	8	140	60 tons per annum.	80	1/3	5,760	92,160	1.25 annas per ton mile plus No. 1.25 per ton, terminal charge.	14,400
Ayana.	24	84	112	74	8	141	60 tons per annum.	81	1/3	5,103	1,22,172	1.25 annas per ton mile plus No. 1.25 per ton, terminal charge.	15,947
Zlawah.	31	120	112	105	8	140	60 tons per annum.	80	1/3	7,200	2,23,200	1.25 annas per ton mile plus No. 1.25 per ton, terminal charge.	28,438
Total.	...	372	41,064 Say 41,700	...	...	...	...	...	...	20,948 Say 21,050	4,63,752 Say 4,61,000	...	62,410 Say 63,000

Estimated earnings from exports per mile week Ra. 40
 Average Load. Miles 22
 Average Export per capita per annum Ton 0.5
 Average Earning per capita Ra. 1.5

Note (a).—At 14 maunds per capita including allowances for cattle food and seeds=say tons per square mile per annum.

13. *Imports.*—The volume of imports to be dealt with by the tramway is difficult to estimate. The people will bring a good deal of their requirements as luggage on their way back from the various weekly "Hats." My only guide is the Revenue figures of the Custom Department as quoted in the Administrative Report of the State. These figures only deal with imports from outside Kotah limits and so must be below the actual average of what is likely to come in by the tramway. I have taken them however, because inter-station traffic has been included in the exports.

The import figures for 1914-15 amount to 16,50,000 maunds.

= Say 61,000 tons.

The population of the whole of Kotah State is 6,39,000, so that the average imports per capita is roughly 0.1 ton.

The imports on the tramway, on this assumption, will therefore be :—

$41,700 \times 0.1 = 4,170$ tons.

Tons $4,170 \times$ average lead of 22 miles = 45,870 ton miles.

Say 46,000 ton miles.

Earnings from Imports = Rs. 8,807 say Rs. 8,800.

14. *Abstract of Estimate of the Gross Earnings :—*

	Rs.
Coaching	45,000
Exports	63,000
Imports	8,800
Total	<u>1,16,800</u>

15. *Working Expenses.*—Daily Load.

325 passengers at 0.5 ton each = 163 tons.

say 70 tons freight at 1.43 tons load per ton freight = 100 "

Average daily load = 263 "

Say two trains a day, for the convenience of passengers. Train mileage:—

Daily 2×30.5 = 61 train miles.

Yearly 61×365 = 22,265 " "

Say 22,300 " "

Fixed expenses :—

	Rs.
Engineering at 300 per mile 31×300	= 9,300
General charges at 150 per mile 31×150	= 4,650
Total	<u>13,950</u>

Variable expenses :—

	Rs.
Loco. 22,300 train miles at Rs. 0.5	= 11,150
Carriage and Wagon 22,300 train miles at as. 0.0	= 1,255
Traffic, (all items except Station Staff) 22,300 train miles at as. 2	= 2,787
Station Staff	5,820
Transshipment, 25,550 tons at as. 2	= 3,193
Total	<u>24,214</u>

Abstract of working expenses :—

	Rs.
Fixed Charges	13,950
Variable Expenditure	24,214
Total working Expenses	<u>38,164</u>
Say	38,000

Cost per train mile = Rs. 1.7.

Proportion of Gross Earnings say 33 per cent.

6. *Estimated net earnings:—*

	Rs.
Gross Earnings	1,16,500
Working Expenses	38,000
Probable net Earnings	78,500

17. *Dividend Prospects.*—The probable net earnings of Rs. 78,500 for an expenditure of Rs. 12,87,100 represents interest on Capital at the rate of 6 per cent.

II.—BARAN TO AKLERA WITH A BRANCH TO SANGOD.

	Miles.
Main line length 53.5	
Branch line „ 9	
Total length	62.5 miles (entirely in Kotah State)

1. *Gauge*—2 feet 6 inches.

2. *Fixed Point.*—The “fixed point” or zero from which the mileage of the Baran-Aklera Feeder Railway is reckoned is the centre of the Feeder Railway terminus at Baran. This proposed terminus at Baran will be common to both the Baran-Etawah and Baran-Aklera feeder lines. The zero or “Fixed point” of the branch line from Bopour to Sangod, is the centre of Bopour Station, mile 12.5 of the Baran-Aklera Railway.

3. *Length of Line.*—The proposed feeder railway together with its branch line from Bopour to Sangod is entirely in the Kotah State. The main line from Baran to Aklera is 53.5 miles and the branch line from Bopour to Sangod is 9 miles; making a total length of 62.5 miles.

4. *Gradients and Curves.*—Except at “dips,” where a grade of 1 in 100 or even 1 in 50 may have to be used, the ruling gradient for the rest is 1 in 150. There will be no sharp curves.

5. *Location.*—Up to mile 30 on the main line, and right up to Sangod on the Bopour-Sangod branch line, the location requires no comment. The country is easy and consists of well cultivated wide rolling downs. From Bopour, mile 13, to mile 30 along the main line, the country assumes the aspect of a wide and rich valley gently rising to the south and bounded on the east by the Shergarh hills and on the west by the Mukandwara range. From mile 30 to mile 32, a rough and rocky ridge more or less continuous runs from the Mukandwara to the Shergarh hills. Both the ascent on the north and the descent into the Sarola basin on the south will be easy on the ruling grade.

At mile 40, to avoid crossing the Mukandwara hills and the rough country about Taraj, an easy alternative *via* Sarthal presents itself. But this alternative is unfortunately $3\frac{1}{2}$ miles longer and it also involves the crossing of the Parwan river. I therefore, suggest the adoption of the shorter route proposed by the Kotah Durbar. That alignment crosses the Mukandwara hills at mile 45 by a cutting of an approximate length of $\frac{1}{2}$ mile and an extreme depth of about 20 feet. The earthwork and bridging throughout, except between miles 30 to 34 and 44 to 47 is light. The only important rivers crossed are:—

1. the Parwan river at mile 11.
2. the Ghar nala at mile 48.

A masonry causeway exists on the Parwan which might be used for a “dip” for the tramway. A grade of 1 in 50 may have to be used in the approaches, to save length. The total fall is about 40 feet. Twentyone spans of 60 feet girders would be required to bridge it at a cost of roughly Rs. 3,75,000. The Ghar-nala is easier and can be crossed easily by a dip, or bridged by 10 spans of 60 feet girders.

6. *Alternative Routes.*—The only alternative which I can suggest is the one from mile 40 to Sarthal. If the board gauge line from Pachpahar to Ohhabra be built as it would pass in the vicinity of both Aklera and Sarthal, then the alternative from mile 40 to Sarthal would be decidedly the better of the two

routes as there would be no necessity to take the narrow gauge railway to Aklera. But if the railway from Pachpahar to Chhabra is not to be built, then the alignment suggested is the better one as it is shorter and costs about the same as the longer route. Aklera being the headquarters of a nizamat, must, for administrative convenience, be accessible by railway.

7. *Extensions.*—The extension of the main line from Aklera to Manohar Thana is contemplated and is dealt with in the next chapter. The branch line from Bopour to Sangod may be extended to the banks of the Kali Sind river $5\frac{1}{2}$ miles further west. It should not be extended beyond, as otherwise it would be in competition with the existing railways. It will serve to divert traffic from the Baran-Kotah to the Bombay, Baroda and the Central India Railway at Duriyah.

8. *Cost of construction*—The probable cost of constructing a narrow gauge feeder railway from Baran to Aklera with a branch line from Bopour to Sangod is, for a fully bridged line:—

	Rs.	Rs.
Main line	26,64,800 or 49,800 per mile.	
Branch line	3,73,500 or 41,500 "	

9. *Abstract of the probable cost of construction.*—

Main heads.	MAIN LINE LENGTH 63.5 MILES.		BRANCH LINE BOPOUR TO SANGOD LENGTH 9 MILES.		WHOLE LINE LENGTH 72.5 MILES.	
	Total by main heads.	Rate per mile.	Total by main heads.	Rate per mile.	Total by main heads.	Rate per mile.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
I.—Preliminary Expenses	21,400	400	2,700	300	24,100	325 9 7 $\frac{1}{2}$
II.—Land . . . . .	...	...	...	...	...	...
III.—Formation . . .	3,68,100	6,000	27,000	3,000	3,95,100	6,081 9 7 $\frac{1}{2}$
IV.—Bridgework . . .	6,20,600	11,600	18,000	2,000	6,38,600	10,217 9 7 $\frac{1}{2}$
V.—Fencing, etc. . .	16,050	800	2,700	300	18,750	300 0 0
VI.—Electric Telegraph .	26,750	100	4,500	500	31,250	600 0 0
VII.—Ballast and Permanent Way.	11,23,600	21,000	1,39,000	21,000	13,12,600	21,000 0 0
VIII.—Stations and Offices.	1,07,000	2,000	18,000	2,500	1,25,000	2,070 0 0
IX.—Plant	21,400	400	3,600	400	25,000	400 0 0
X.—Ferries . . . . .	...	...	...	...	...	...
XI.—Rolling Stock . .	2,67,000	5,000	90,000	10,000	3,57,000	6,720 0 0
XII.—General charges .	1,07,000	2,000	18,000	2,000	1,25,000	2,000 0 0
Total	26,64,800	49,800	3,73,500	41,500	30,37,800	48,605 0 0

10. *Traffic and Dividend Prospects.*—Except for the two belts of hilly and rocky ground at miles 30 and 45, the rest of the country is almost entirely under cultivation. The crops were as good as any I have ever seen. When no restrictions exist on export the surplus is almost all carted and disposed of *via* Baran and Pachpahar. Owing to restrictions this year, a good deal went to Sukhet, a station on the Nagda-Muttra within Kotah State. Should the broad gauge railway from Pachpahar *via* Jhalrapatan be extended to Aklera, most of the traffic will go by that line and the feeder railway will bring in to Aklera station the surplus produce of the rich basin of Sarola and of the valley beyond. If the proposed broad gauge is not built, owing to the long leads to the mardis by road, the traffic will go to Baran by tramway.

11. *Gross Earnings.*—Conching.—Owing to traffic not following the main lines of road only, it was impossible to establish posts which would check all

the village paths. A good many of the passengers to Kotah go *via* Jhalra-patan and Morak because it is cheaper.

In estimating the coaching earnings we shall be quite safe in taking the Re. 1.1 average earnings per capita found to be the case for the Baran-Etawah tramway. If anything it will give us a slight underestimate on account of the longer lead on this proposed feeder. On this assumption the coaching earnings come to :—

	Re.	Rs.
Main Line 64,200 at 1.1	.	=70,620
Branch 10,800 at 1.1	.	=11,880
Total	.	82,500

12. Goods Earnings.—Imports; main and branch line.

Stations	Population served.	Importers.	Distance for charge.	Ton miles.	Rate.	Earnings.
		Tons.	Miles.		1½ anna per ton mile plus Re. 1.25 per ton, terminal charge.	Rs.
Bopour	8,400	840	13	10,920		1,903
Khanpur	13,440	1,344	27	36,288		4,516
Barola	8,600	860	36	30,960		3,494
Taraj	6,700	670	43	28,810		3,089
Atlera	13,200	1,320	54	71,280		7,219
Wangod	10,800	1,080	22	23,760		3,206
Totals	61,140	6,114	...	2,02,018	...	23,426

Average Lead Miles 33

Average Earnings per capita Re. 0.38

13. Exports, main and branch line.—Traffic area under crops :—

	Square miles
Main line	500
Branch line	100
Total	600

Surplus produce available for export :—80 tons per square mile.

Proportion expected to use the railway :— $\frac{1}{2}$ the surplus, i.e., 40 tons per square mile.

Total export and inter station traffic :—

$$600 \times 40 = 24,000 \text{ tons.}$$

The mean lead is 33 miles,

$$24,000 \times 33 = 7,92,000 \text{ ton miles.}$$

at $1\frac{1}{2}$ annas per ton mile, plus Re. 1.25 per ton, terminal charge = Rs. 91,875.

14. Abstract of Probable Gross Earnings :—

	Rs.
Coaching	82,500
Imports	23,426
Exports	91,875
Total	1,97,801 say 2,00,000

15. *Working Expenses*.—2 trains a day will be ample to deal with the anticipated traffic, so that the train mileage will be:—

Daily $2 \times 62.5 = 125$ train miles.

Yearly $125 \times 365 = 45,625$ train miles.

Fixed Expenses:—

	Rs.
Engineering at Rs. 300 per mile	= 18,750
General charges at Rs. 150 per mile	= 9,375
Total	<u>28,125 say 28,000</u>

Variable Expenses:—

	Rs.
Locomotive 45,625 train miles at Re. 0.5 per train mile	= 22,813
Carriage and Wagon at annas 0.9 per train mile	= 2,566
Traffic (except station staff) at 2 annas per train mile	= 5,703
Traffic, station staff, 6 stations at Rs. 1,200 each	= 7,200
Transshipment, 30,000 tons at 2 annas per ton	= 3,750
Total	<u>42,032 say 42,000</u>

Abstract of Working Expenses:—

	Rs.
Fixed Charges	28,000
Variable Expenditure	42,000
Total	<u>70,000</u>

Cost per train mile = Re. 1.5.

proportion of working Expenses to Gross Earnings = 35 per cent.

16. *Estimated Net Earnings*.—(main and branch line).

	Rs.
Gross Earnings	2,00,000
Working Expenses	70,000
Probable Net Earnings	<u>1,30,000</u>

17. *Dividend Prospects*.—The capital outlay for the construction of the Baran-Aklara feeder railway with a branch line from Bopour to Sangod is Rs. 30,37,900 and the expected net earnings are Rs. 1,30,000. This represents interest on capital at the rate of 4.3 per cent.

III.—AKLERA TO MANOHAR THANA.

Length 19.5 miles. (Entirely in Kotah State.)

1. *Gauge*.—2 feet 6 inches.
2. *Fixed Point*.—Centre of the proposed feeder railway station at Aklara.
3. *Length of line*.—The distance from Aklara to Manohar Thana is 19.5 miles.
4. *Gradients and Curves*.—The ruling gradient is 1 in 150. There will be no sharp curves.
5. *Location*.—The country is the same as that previously described; an undulating plateau studded with hills more or less connected. It rises gently all the way to Manohar Thana. The only river of importance crossed is the Newaj at mile 6. The Parwan is not crossed; the station at Manohar Thana

is kept on the west bank of the river. Both bridging and earthwork are moderate. On an average it is the same as that for the proposed line from Baran to Aklera of which this line to Manohar Thana is an extension. The Newaj, if bridged, will require 9 spans of 60 feet girders. It can also be easily dipped. On the whole the location requires no special note.

6. *Alternative Routes.*—Should the proposed broad gauge railway from Pachpahar *via* Jhalrapatan to Chhabra be built as far as Sarthal, then as mentioned before there would be no necessity for the narrow gauge feeder railway to Aklera. The cheaper and shorter route for the feeder railway from Baran to Manohar Thana would be *via* the alternative from mile 40 of the Baran-Aklera line to Sarthal and then along the east bank of the Parwan river to opposite Manohar Thana. This would give a short and cheap line. Any extension from the proposed present terminus opposite Manohar Thana is bound to prove expensive. The country from there becomes very broken and cut up by deep and precipitous ravines.

7. *Cost of construction.*—The probable cost of construction amounts to Rs. 9,36,000 or Rs. 48,000 per mile.

8. *Abstract of the probable cost of construction.*—(10·5 miles)

Main Heads.	Total by Main Heads.	Rate per Mile.	REMARKS
	Rs.	Rs.	
I.—Preliminary Expenses	7,800	400	
II.—Land . . . . .	...	...
III.—Formation	68,600	3,000	
IV.—Bridgework	1,63,500	8,400	Including bridge over Newaj.
V.—Fencing	6,850	500	
VI.—Electric Telegraph	9,750	500	
VII.—Ballast and Permanent Way	4,00,600	21,000	
VIII.—Stations and Offices	80,000	2,000	
IX.—Plant	7,800	400	
X.—Fittings . . . . .	...	...
XI.—Rolling Stock	1,95,000	10,000	
XII.—General Charges	39,000	2,000	
Total	9,36,000	48,000	

9. *Traffic and Dividend Prospects.*—Beyond mile 6, the country is poorly cultivated; but the deficit in surplus produce will be made up by the greater area served. Manohar Thana has two fairs a year which are attended by about 50,000 people. To these fairs all sorts of traders come from all over the country. If the line from Pachpahar to Chhabra be built as far as Aklera, all the traffic of Manohar Thana will come and go that way. If it is not built the bulk of the traffic will go through Baran and the earnings of the Baran-Aklera line due to this extension should be credited to the extension. I am, however, estimating the earnings of the Aklera-Manohar Thana extension as if the broad gauge line to Aklera was built.

10. *Gross Earnings.*—Coaching :—

	Rs.	Rs.
24,000 at Re. 1·1	=26,400	
Traffic due to Fairs, 25,000 at Re. 1	=25,000	
Total	51,400 say 51,000	

11. *Goods earnings*.—Imports. Taking the same figure as for the other railways in Kotah State, we have :—

$$24,000 \times \text{Rs. } 0.38 = \text{Rs. } 9,120, \text{ say Rs. } 9,000.$$

12. *Exports*.—Leaving out what will come from Kilchipur and Rajgarh and dealing only with the produce of the area served in Kotah State, we find :

Traffic area under crops 160 square miles.

Surplus produce available for export.—50 tons per square mile.

Proportion expected to use the railway.— $\frac{1}{2}$ the surplus, i.e., 25 tons per sq. mile.

Total export and inter-station traffic.— $160 \times 25 = 4,000$ tons.

Mean lead 15 miles.

$$4,000 \times 15 = 60,000 \text{ ton miles.}$$

At $1\frac{1}{4}$ anna per ton mile, plus Rs. 1.25 per ton terminal charge

$$= \text{Rs. } 9,688, \text{ say Rs. } 10,000.$$

13. *Abstract of probable gross earnings* :—

	Rs.
Coaching	61,000
Imports	9,000
Exports	10,000
Total	<u>70,000</u>

14. *Working expenses*.—At 35 per cent. of gross earnings = Rs. 24,500 say Rs. 25,000.

15. *Estimated net earnings* :—

	Rs.
Gross earnings	70,000
Working expenses	<u>25,000</u>
Probable net earnings	<u>45,000</u>

16. *Dividend prospects*.—The probable cost of the Aklera-Manohar Thana feeder railway fully bridged on the 2 feet 6 inch gauge is Rs. 9,30,000. The estimated net earnings are Rs. 45,000, representing a return on capital cost of 4.8 per cent.

17. This line will form the last link to a satisfactory system of feeder railways within the Kotah State. The total mileage of railways will be :—

	Miles.
1. Baran to Etawah	30.5
2. Baran to Aklera, with a branch to Sangod	62.5
3. Aklera to Manohar Thana	19.5
Total	<u>112.5</u>

The lines, besides being of great administrative convenience, will be of great economic value to develop those fertile parts which are so handicapped at present for want of proper communications. They will constitute a sound investment within the State and will, by their indirect advantages, benefit the State and people equally. They will not compete with existing railways.

IV.—JHALRAPATAN TO SALAMATPUR.

LENGTH 136·8 MILES.

Length of line in each Native State traversed.

	Miles.
Jhalawar	7·5
Gwalior	21·3
Tonk	2·3
Indore	25·3
Kilchipur	15·0
Rajgarh	25·8
Narsinghgarh	14·6
Bhopal	27·0

1. *Gauge*.—2 feet 6 inches, same as other feeder railways.
2. *Fixed point*.—The mileage is reckoned from the proposed feeder railway terminus at Jhalrapatan.
3. *Length of line*.—The distance from Jhalrapatan to Salamatpur along the route indicated is 136·8 miles. The portion of the line from Jhalrapatan to Sohct, mile 23, is common to both the Jhalrapatan-Salamatpur and the Jhalrapatan-Agar-Ujjain feeder railways.
4. *Gradients and curves*.—The ruling grade is 1 in 100, or 1 per cent. Curvature will not exceed 5 degrees.
5. *General remarks*.—This line will form the most important section of the system of economic railways suggested for the development of the country under survey. The value of this line in opening out the land locked area of Kilchipur, Rajgarh and Narsinghgarh, is incalculable. The line will connect the detached districts of various States like Gwalior, Indore and Tonk, and bring more cohesion to their administration. New markets will be established along the railway line to which the cultivators will be able to sell their produce without having to waste the time and money which they have to at present. The rate of transport from the centre of the area to the markets along the existing railway lines is roughly Rs. 12 per ton. This cost is paid by the cultivator, as the rates paid to him for his produce vary according to the distance from the railway. By the construction of the new railway, the combined rate of cartage and carriage by feeder railway will be less than half the present rate, and the cultivator will on an average get Rs. 1·8 to Rs. 3 more per acre he cultivates. The cost of his imported domestic requirements and petty luxuries will also be much less.

The line will conflict with no existing interests, nor will it prejudice the long contemplated scheme of the Central India Agency for a broad gauge railway from Gwalior *via* Goona and Maksi to Indore and on to the Tapti Valley Railway; following more or less the alignment of the Bombay-Agra trunk road between Gwalior and Maksi. Though that line would be of immense value to the country under survey, a purely local line between Goona and Maksi on the broad gauge will not pay. But as a through line from Gwalior to the Tapti valley and as a short cut to Bombay, that line would be, as suggested by the Secretary, Public Works Department, Central India Agency, equal to if not more in efficiency to the doubling of the Great Indian Peninsula Railway between Gwalior and Itarsi.

6. *Junctions*.—The selection of junctions has been guided, not only by the general direction of the traffic, but also by an endeavour to secure a united system of economic railways to avoid the dangers of competition and wasteful management.

In normal times the traffic, of the country, as far as Kilchipur goes to Pachpahar. That of the south and east of Kilchipur goes to the Great Indian Peninsula Railway. As Jhalrapatan is to be connected to Pachpahar by a broad gauge line, it becomes the correct place to start from in the north.

For the selection of Salamatpur on the Bina Bhopal Railway, I am indebted to Sir Vivian O. Bosanquet. My own selection had been Bhilsa on account of its importance and easy accessibility; but, as Sir Vivian pointed out, amongst other reasons, since a line from Salamatpur to Raisen is contemplated,

it would be far better to join also at Salamatpur rather than create another junction. I fully agree with him.

The portion of the line from Jhalrapatan to Sohet, mile 23, will be common to both the lines going to Ujjain and Salamatpur, thus making them parts of the same system of railways.

The proposed Kotah feeder railways could also be joined to this system by the construction of a line from Aklera to somewhere near Richwan.

7. *Location*.—From Jhalrapatan to Sohet and then on to Machalpur and Zirapur, the country requires no special comment. Between Zirapur and Kilchipur, the country is cut up by nalas, and this is much more accentuated between Kilchipur to 7 miles east of Rajgarh where easy country is again met with along the valley of the Ajnar. The valley of the Ajnar nala is followed right up to mile 92, where the hills surrounding Narsingharh are crossed by a gap. From mile 124, turning south-south-east the line proceeds to Salamatpur which is reached at mile 136.8.

The following important rivers are crossed :—

Chauli nala	mile 4,	7 spans of	60 ft. girders.
Khartali river	„ 24,	7 „ „	60 „ „
Kali Sind	„ 26,	7 „ „	100 „ „
Chappi nala	„ 46,	4 „ „	40 „ „
Ghar nala.	„ 53,	5 „ „	60 „ „
Newaj	„ 64,	6 „ „	60 „ „
Parbati	„ 98,	6 „ „	100 „ „
Bae	„ 114,	4 „ „	40 „ „
Betwa	„ 135,	10 „ „	60 „ „

8. *Alternative routes*.—If Kilchipur and Rajgarh were not obligatory points on the route, through open country and almost on the watershed the line could go direct to Pachor on the Agra-Bombay road from Zirapur. From Pachor through equally easy country, the line would make for Narsingharh. That alignment would leave Kilchipur and Rajgarh 10 and 14 miles away respectively from the railway.

9. *Extensions*.—The extension from Barasia to Sironj is dealt with separately in the next chapter.

10. *Construction and engineering*.—The standard of construction will be the same as that of the other narrow gauge railways previously described. The rough estimates are based on the assumption that the line will be fully bridged straight away. Good building stone, as well as lime stone and kankar are available at many places along the route. Labour is scarce and will have to be imported.

11. *Probable cost of construction*.—The total cost of construction of a fully bridged 2 ft. 6 inches railway from Jhalrapatan to Salamatpur is Rs. 73,56,900 or Rs. 53,700 per mile.

12. *Abstract of the probable cost of construction*.—(137 miles).

Main heads.	Total by main heads.	Rate per mile.
	Rs.	Rs.
I. Preliminary expenses	68,500	500
II. Land	...	...
III. Formation	6,85,000	5,000
IV. Bridgework	16,44,000	12,000
V. Fencing, etc.	41,100	300
VI. Electric telegraph	68,500	500
VII. Ballast and permanent-way	28,77,000	21,000
VIII. Stations and buildings	2,74,000	2,000
IX. Plant	54,800	400
X. Ferries	...	...
XI. Rolling stock	13,70,000	10,000
XII. General charges	2,74,000	2,000
Total	73,56,900	53,700

TRAFFIC PROSPECTS.

13. *General remarks.*—As already mentioned, the traffic as far as Kilchipur goes to the Nagda-Muttra Railway and that of the south and east of Kilchipur goes to the Great Indian Peninsula Railway.

The country on the whole, except the rocky areas under forests or scrub jungle, is productive. In addition to grain and other foodstuffs, cotton and forest produce will be exported in larger quantity than hitherto possible. There are many cattle fairs from which a large number of cattle are yearly exported.

A mail motor service runs at present from Sehore *via* Narsingharh and Rajgarh to Kilchipur. It is chiefly intended for mails and takes only four or five passengers.

14. *Chief traffic points.*—Sohet, Mile 23—A village of Gwalior State. Population 1,879. Is the centre of the trade of the neighbourhood. Has one ginning factory. Owing to State restrictions at present, all its trade is with Ujjain. In normal times it goes to Pachpahar. A weekly market is held at Sohet which is largely attended.

Machalpur.—Mile 30. Headquarters of thana in Indore State, population 3,000.

Zirapur.—Mile 41. Headquarters of pargana in Indore State, population 3,100.

Kilchipur.—Mile 53, capital of the State of same name. Population 5,000. Three cattle fairs are held annually attended on an average by 45,000 people each. The trade is carried out by Jain and Hindu baniahs and Mohammedan Bhoras. The former deal in opium, grain and piece goods and the latter in hardware. Kilchipur carries out the entrepot trade for the interior of the area under survey.

Rajgarh.—Mile 64. Capital of the State of the same name, population 6,500. A large cattle fair is held at Rajgarh in January.

Biaora.—Mile 76. Headquarters of pargana and important trade centre of Rajgarh State, 42 miles by road from Shujalpur station on the Bhopal-Ujjain Branch. Population 6,476. A large weekly market is held every Monday and a cattle fair yearly in April. It also has a ginning factory.

Narsingharh.—Mile 93. Capital of State of same name. Population 9,000. Five cattle fairs are held annually in the state which are largely attended.

Bairasia.—Mile 116. Trade centre in Bhopal State. Population 4,300. Twenty-four miles by road from Bhopal.

15. *Probable gross earnings.*—Coaching.

Taking the coaching earnings at Re. 1 per capita per annum, which is very conservative, taking into account the number of fairs which take place, we have.

Population served in a 12 mile belt:—

	Rs.
137 × 12 × 100 =	1,64,000
1,64,000 × Re. 1 =	1,64,000
say	1,64,000

16. *Goods earnings*.—Imports, (from States' customs figures).

Trade centres.	Mileage.	Distance for charge.	Imports.	Ton miles.	Rate.	Earnings.
			Tons.			Rs.
Jhalrapatan . . . . .	...	...	...	...	1½ anna per ton mile, plus Rs 1.25 per ton terminal charge.	...
Sohet	23	23	1,400	32,200		4,265
Machalpur	30	30	2,100	63,000		7,547
Zirapur	41	41	2,200	90,200		9,797
Kilchipur	53	84	27,000	22,68,000		2,10,938
Rajgarh	64	73	2,400	1,75,200		16,688
Biaora	76	61	1,200	72,200		7,140
Narsinghgarh	93	44	4,000	1,70,000		18,750
Barasia	116	21	600	12,600		1,784
Salamatpur	137	...	...	...		...
Totals . . . . .	...	...	40,700	28,89,400	...	2,76,859 say 2,77,000

Average lead Mile 71

Average earnings per capita Rs. 1.7

17. *Goods earnings*.—Export (as per States' customs figures).

Trade centres.	Mileage.	Distance for charge.	Export.	Ton miles.	Rate.	Earnings.
			Tons.			Rs.
Jhalrapatan . . . . .	...	...	...	...	1½ anna per ton mile, plus Rs. 1.25 per ton terminal charge.	...
Sohet	23	...	...	...		(a)...
Machalpur	30	7	2,200	15,400		3,953
Zirapur	41	18	3,000	54,000		7,656
Kilchipur	53	84	10,000	15,96,000		1,48,438
Rajgarh	64	73	2,800	2,04,100		19,469
Biaora	76	61	600	36,600		3,610
Narsinghgarh	93	44	800	35,200		3,750
Barasia	116	21	900	18,900		2,602
Salamatpur	137	...	...	...		...
Totals . . . . .	...	...	29,800	19,60,500	...	1,89,478 Say 1,89,500

Average lead Miles 67

Average earning per capita Rs. 1.1

NOTE.—(a) The exports of Sohet will go to Ujjain *via* Agar. The exports of Machalpur and Zirapur will go to Indore *via* Sohet and Ujjain.

18. *Goods earnings*.—Miscellaneous. From the ten cattle fairs, which take place during the year along the proposed railway, I do not think it too optimistic to expect 100 heads from each fair to use the railway.

1,000 at 3 annas per head per mile for a mean lead of 72 miles Rs. 13,500
Say 14,000

19. *Abstract of gross earnings—*

	Rs.
Coaching	1,64,000
Imports	2,77,000
Exports	1,89,500
Miscellaneous	14,000
Total	<u>6,44,500</u>

20. *Working expenses.*—Three trains a day would be more than enough to deal with the estimated traffic, but to ensure a thorough efficient service so as to serve public convenience best four trains a day, two each way, may have to be run.

Train mileage ; $4 \times 137 \times 365 =$ 200,020 train miles,
 Say 200,000 train miles,

Fixed charges :—

	Rs.
Engineering maintenance, 137 miles at Rs. 300 per mile =	41,100
General charges 137 miles at Rs. 150 per mile =	20,550
Total	<u>61,650</u>
Say	62,000

Variable expenses :—

Locomotive, 200,000 train miles at Rs. 0.5 per train mile	1,00,000
Carriage and wagon, 200,000 train miles at anna 0.9 per train mile =	11,250
Traffic 2,00,000 train miles at annas 2 per train mile =	25,000
Traffic station staff, 10 stations at Rs. 1,200 each =	12,000
Traffic junctions at Rs. 5,000 each =	1,000
Traffic transshipment, 70,000 tons, at annas 2 per ton =	8,750
TOTAL	<u>1,58,000</u>

Abstract of working expenses :—

Fixed expenses	62,000
Variable expenditure	1,58,000
TOTAL	<u>2,20,000</u>

Cost per train mile 1.1
 Proportion of working expenses to gross earnings 84.3 per cent.

21. *Estimated net earnings—*

Gross earnings	6,44,500
Working expenses	<u>2,20,000</u>
Probable net earnings	<u>4,24,500</u>

22. *Dividend prospects—*

Probable capital outlay =	78,56,900
Probable net earnings =	4,24,500
Interest on capital	5.7 per cent.

Say . 74,000

11. *Abstract of gross earnings—*

	Rs.
Coaching	44,000
Goods	74,000
TOTAL	1,18,000

12. *Working expenses.*—On the assumption of one train each way a day and at 40 per cent. of the gross earnings, the working expenses are Rs. 47,200 say Rs. 47,000.

13. *Probable net earnings—*

	Rs.
Gross earnings	1,18,000
Working expenses	47,000
Net earnings	71,000

14. *Dividend prospects—*

	Rs.
Probable capital outlay	= 18,24,000
Probable net earnings	= 71,000
Interest on capital	= 3.8 per cent.

(V) JHALRAPATAN TO UJJAIN, VIA AGAR.

LENGTH 99 MILES.

Length of line in each Native State traversed—

	Miles.
Gwalior	71.75
Indore	17.50
Jhalawar	7.50
Tonk	2.25

1. *Gauge*—2 ft. 6 inches.

2. *Fixed point*—The mileage is reckoned from the proposed feeder railway terminus at Jhalrapatan.

3. *Length of line.*—The proposed line will be 99 miles long. The portion of the line from Jhalrapatan to Soheli, mile 23, is common to both the Jhalrapatan-Ujjain and Jhalrapatan-Salamaspur Railways.

4. *Gradients and curves.*—To minimise work, the ruling grade has been taken as 1 per cent. or 1 in 100. There will be no need for sharp curvature.

5. *General remarks.*—The line was suggested by the Gwalior Darbar, who only intended to construct it as far as Soheli, the most northern village in this portion of Gwalior territory. The evident intention of the line is to connect the industrial centre of Ujjain to the producing areas. In my opinion it will be a mistake not to extend the line to Jhalrapatan, even if the latter place is connected by a broad gauge railway to Pachpahar. In normal times, Pachpahar is the natural channel for the traffic of this country and if the line is not extended as far as Jhalrapatan, traffic will be carted to there. It will be the case of Baran on the Baran-Kotah. Besides it will also be to the advantage of Ujjain to have a larger field to draw its raw materials from. If the line is not connected to Jhalrapatan, the traffic earnings will be adversely affected, as there are many commodities which are not required by Ujjain and which are exported to the north. These will go to Jhalrapatan and the railway will get 23 miles lead on them.

The line on the 2 ft. 6 inches gauge will not compete with the Bombay, Baroda and Central India Railway, on the contrary, on account of the greater facility afforded to the cultivator to dispose of his surplus produce, more land will be brought under the plough and greater exports will result. Should the metre gauge from Indore to Ujjain be extended, then the earnings of the Nagda-Muttra would be affected. The interests of the country will be best

served by a narrow gauge, because I doubt very much if a metre gauge could be cheaply built between Agar and Sohet. The metre gauge would very likely stop at Agar and leave the rest of the country just as badly off for communications as they were before. Furthermore, what I really believe to be the need of the country to ensure its early development, is a united system of cheap railways, and very much as I regret to have to suggest the introduction of a third gauge in these parts, it is my considered belief that the 2 ft. 6 inches gauge is the best for this country.

6. *Location*.—The alignment suggested follows all the way to Ujjain the Jhalrapatan-Ujjain road. The only portion requiring comment is the rough country lying between Agar and Sohet. It rises from an approximate level of 1143 at Sohet to 1633 at Agar in four sudden steps involving rather a lot of work. The rest of the country is easy. On the whole, the work is light for a 2 ft. 6 inches gauge. The drainage is simple and amounts to 25 ft. per mile. The important rivers crossed are :—

Chauli nala, mile 4, 7 spans of 60 ft. girders.

Khantali, mile 30, 7 spans of 60 ft. girders.

Ohota Kali Sind, mile 71, 8 spans of 60 ft. girders.

7. *Construction and engineering*.—The line will be built and equipped to the same standard as the other feeder railways described before.

8. *Probable cost of construction*.—The probable total cost of construction of a fully bridged 2 ft. 6 inches gauge railway from Sohet to Ujjain *vid* Agar is Rs. 34,88,400 or Rs. 45,900 per mile, the length from Jhalrapatan to Sohet has been included in the Jhalrapatan-Salamatpur Railway.

9. *Abstract of the probable cost of construction*.—Length 76 miles only, the first 23 miles from Jhalrapatan to Sohet have been included in the Jhalrapatan-Salamatpur Railway.

Main heads.	Total by main heads.	Rate per mile.
	Rs.	Rs.
I.—Preliminary expenses	38,000	500
II.—Land . . . . .	...	...
III.—Formation	8,19,200	4,200
IV.—Bridgework	3,80,000	5,000
V.—Fencing, etc.	22,800	300
VI.—Electric telegraph	38,000	500
VII.—Ballast and permanent-way	15,06,000	21,000
VIII.—Stations and buildings	1,52,000	2,000
IX.—Plant	30,400	400
X.—Ferries . . . . .	...	...
XI.—Rolling stock	7,60,000	10,000
XII.—General charges	1,52,000	2,000
TOTAL	34,88,400	45,900

TRAFFIC PROSPECTS.

10. *General remarks*.—Owing to restrictions imposed by the States on exports, all the exports of the Gwalior territory will go to Ujjain. The imports, north of Agar, will come *vid* Pachpahar.

11. *Chief traffic points.*—Sohet, mile 23, already described.

Susner, mile 41, headquarters of tehsil in Gwalior State. Population 3,700. Has a ginning factory; two cattle fairs are held annually. The imports and exports of Susner proper are 8,000 maunds and 11,000 maunds, respectively, but it will receive the traffic of Dag which is even more as well as the traffic of surrounding villages.

Agar, mile 58. Town in Gwalior State, and British military station 41 miles by metalled road from Ujjain. Population 10,442. Possesses 2 ginning factories and does a considerable traffic in grain and cotton. A motor service connects Agar to Ujjain. A large cattle fair is held annually at Agar and about 40,000 cattle are brought in for sale.

Ghatia, mile 83. A large village and busy centre in Gwalior State. Connected to Agar and Ujjain by motor service. This station will receive a fair amount of traffic from Mehidpur and Tarana.

Ujjain, mile 99. A large town and busy industrial centre in Gwalior State. It is the junction of the Bhopal-Ujjain, Nagda-Ujjain and Indore-Ujjain Railways. It has several factories and mills. It consumes locally about 20,000 cotton bales and exports from its presses 60 to 80 thousand.

12. *Probable gross earnings.*—Coaching.

	Rs.
Traffic area	=900
Population served	=108,000
Rural traffic	=98,000 x Re. 1 =98,000
Agar town traffic	=10,400 at Re. 1.5 =15,600
TOTAL	1,13,600
Say	1,14,000

13. *Goods earnings.*—Imports and exports.

Trade Centres.	Mileage.	Distance for charge.	Export and Import tons.	Ton mile.	Freight charges.	Earnings. Rs.
Jhalrapatan . . . . .	...	...	...	...	1½ anna per ton mile plus Re. 1½ per ton terminal charge.	...
Sohet	23	70	1,500	1,14,000		10,781
Susner	41	41	1,800	73,800		8,015
Agar	58	41	15,000	6,15,000		66,798
Ghatia	83	16	2,000	32,000		5,000
Ujjain	99	...	...	...		...
TOTALS	...	...	20,300	8,34,800		91,593
					Say	90,000

14. *Fair and cattle traffic.*—I think it is not being too optimistic to expect at least Rs. 40,000 from the numerous fairs taking place along the proposed line and from the interchanged traffic with the Jhalrapatan-Salamatpur Railway

15. *Abstract of gross earnings:*—

	Rs.
Coaching	1,14,000
Goods	90,000
Miscellaneous	40,000
	2,44,000

16. *Working expenses.*—On the assumption of one train a day each way. which is enough to deal with the traffic in sight, we have :—

Yearly train mileage	=73,000	train miles.
Add for fair traffic	2,000	
Total	75,000	train miles yearly.

At Rs. 1·5 per train mile = Rs. 1,12,500.

17. *Probable net earnings :—*

	Rs.
Gross Earnings	2,41,000
Working Expenses	1,12,500
Total net earnings	1,31,500
Say	1,32,000

18. *Dividend prospects :—*

	Rs.
Probable capital outlay	34,88,400
Probable net earnings	1,32,000
Interest on capital	3·7 per cent.

Summary of Results.

Particulars of line.	Gauge.	Length.	Total cost.	Cost per mile.	Probable dividends per cent.	Remarks.
Through line :—						
Neemuch to Pachpahar	3'-3½"	61·5	Rs. 42,88,150	Rs. 69,913	4	
Pachpahar-Jhalrapatan	5'-6"	23	20,52,000	1,02,000	5·3	
Jhalrapatan-Chhabra	"	60	63,36,000	1,05,000	N71.	Loss of Rs. 7,500 per annum.
Feeder Railways :—						
Baran to Etawah	2'-6"	30·5	12,00,300	42,600	6	
Baran to Aklera (with a branch from Bopour to Sanged)	"	62·5	30,37,500	48,605	4·3	
Aklera to Manohar Thana.	"	19·5	9,56,000	48,000	4·8	
Jhalrapatan to Salamatpur	"	136·8	73,50,000	53,700	5·7	
Branch to Sironj	"	38	18,24,000	48,000	3·8	
Jhalrapatan to Ujjain	"	99	34,88,400	45,900	3·7	

Conclusions and recommendations.

To a great extent the genuine hardships of the people of the country surveyed can be alleviated almost at once, by the adoption of the following proposals :—

In sector (ii).—

- The working of the Baran-Kotah Railway to be made over to the Bombay, Baroda and Central India Railway.
- The working of the section of the Baran-Bina Railway from Baran to Goona to be made over to the Bombay, Baroda and Central India Railway.

In sector (i).—

(a) The construction of the line from Neemuch to Pachpahar to be started without delay.

In sector (iii).

This is the sector which wants more relief than any of the others. The progress of the country is absolutely at a standstill for want of railways.

The construction of a broad gauge line from Pachpahar to Jhalrapatan will have very far-reaching effects on the development of the country, and I recommend strongly its early construction while the other schemes are being considered.

BOMBAY,
THE 26TH MARCH 1920. }

H. EDWARDS,
*Engineer in charge, Neemuch-Pachpahar-Goon and
Kota Feeder Railways Reconnaissance Survey.*

APPENDICES.

APPENDIX I.

No. 468-P.—16, dated 3rd October 1919.

From—The Secretary, RAILWAY BOARD.

To—Mr. C. A. H. EDWARDS, Junior Government Inspector of Railways, Circle No. 6, Bombay.

In continuation of the Railway Board's letter No. 468-P.—16, dated 24th September 1919, I am directed to forward herewith a copy of a letter No. 3012, dated 24th September 1919, from the Hon'ble the Agent to the Governor General in Central India to the Government of India in the Foreign and Political Department, and to request that in addition to the lines mentioned in the memorandum forwarded with this office letter No. 468-P.—16, dated 24th September 1919, you will also investigate and report on the lines now recommended by the Agent.

Dated 24th September 1919.

From—The Hon'ble Sir OSWALD VIVIAN BOSANQUET, K.C.S.I., C.I.E., Agent to the Governor General in Central India,

To—The Political Secretary to the Government of India in the Foreign and Political Department.

I have the honour to report that I have instructed the Resident at Gwalior to address the Gwalior Darbar, and I have written to the Indore Darbar, in the terms of Major Ogilvie's letter No. 3966-I. B., dated 27th August 1919, regarding the railway projects for opening up the Kotah and Jhalawar States and connecting them with the Rajputana-Malwa, Nagda-Muttra and Bina-Goonabar lines.

2. From the enclosed blue prints prepared in this office, (a) showing approximately the various alignments indicated in the list of projects on the scale of four miles to the inch and (b) showing the country between the Eastern portion of Kotah and Goona on the scale of one mile to one inch, and from what I know of these tracts personally, I believe that :—

- (i) the best alignment for a chord between the Nagda-Muttra and Rajputana-Malwa Railways will be that of the existing metalled road from Shri Chhatrapur to Neemuch ;
- (ii) a preferable line to that from Pachpahar to Jhalrapatan (which cannot be wanted as well as a line from Shri Chhatrapur to Jhalrapatan) would be one from Pachpahar through Sunel and Raipur (of Indore) to connect at the latter place with an extension of the Ujjain-Sohet line projected by the Gwalior Darbar, which could be continued thence to Jhalrapatan ; and,
- (iii) either Ohhabra or Rothiai would be a better point of junction with the Goona-Baran line than Guna.

APPENDIX II.

No. 3540, dated 17th October 1919.

From—The Secretary to the Hon'ble the Agent to the Governor-General in the Public Works Department, Central India,

To—The Secretary, RAILWAY BOARD.

I am directed to refer to your endorsement No. 468-P.—16, dated the 24th September 1919, regarding the Kotah-Jhalawar Railway projects.

The Indore Darbar, who were consulted, have suggested that :—

- (i) the best alignment for a chord between the Nagda-Muttra and Rajputana Malwa Railways will be that of the existing metalled road from Shri Chhatrapur to Neemuch ; and
- (ii) a preferable line to that from Pachpahar to Jhalrapatan (which cannot be wanted as well as a line from Shri Chhatrapur to Jhalrapatan) will be one from Pachpahar through Sunel to Raipur, to

connect there with an extension of a line projected by the Gwalior Darbar from Ujjain to Sohct which could be continued thence to Jhalrapatan.

I enclose a blue print which shows these routes as well as those proposed by the Kotah and Jhalawar Darbars.

The alignments proposed by the Indore Darbar are undoubtedly the best for opening up that part of the country and as such they are very likely to be proposed also by the Gwalior Darbar. I am, therefore, to suggest that they should be surveyed in the reconnaissance which Mr. Edwards is about to make and the cost of which, it is understood, will be borne by the Government.

A copy of this letter is being forwarded to Mr. Edwards.

APPENDIX III.

No. 1207-T.—5-C-3, dated 20th January 1920.

From—The Agent's Office, Bombay, Baroda and Central India Railway,

To—The Engineer-in-Charge, Neemuch-Pachpahar-Goonā Railway Survey, Jhalrapatin, Rajputana.

With reference to the correspondence ending with your letter No. 50-T. S., dated 6th January 1920, I beg to inform you that the information required by you is not available in our Audit Office. It will have to be extracted from various original documents which will require extra staff and I will let you know shortly the estimated cost of the same to enable you to decide whether the information should be extracted or not.

APPENDIX IV.

No. 67—"Coml. B.," dated 6th February 1920.

From—The General Traffic Manager's Office, Bombay, Great Indian Peninsula Railway,

To—The Engineer-in-Charge, Neemuch-Pachpahar Goona Railway Survey, Camp Jhalrapatan.

I beg to acknowledge receipt of the sketch map which accompanied your No. 106 of 27th January last.

From the position of the line as sketched out, it will be seen that the chord would shorten the distance from stations below Chhabragugar, i.e., towards Goona to stations north of Neemuch.

We do not maintain statistics of traffic booked from each individual station on our line to stations north of Neemuch and I regret it is not possible to furnish you with the information asked for.

I do not think traffic on the Bhopal-Ujjain Branch of this railway will in any way be affected by the opening of the proposed chord.

APPENDIX V.

Results of analysis of the water of Shri Chhatrapur and Pachpahar (expressed in parts per 100,000).

	I.	II.	III.
Total Solids	198.0	34.0	
Chlorine	12.8	2.8	
Free Ammonia . . . . .	.033	.002	
Alb Ammonia . . . . .	.028	.005	
Oxygen absorbed in 2 hours at 37 per cent. . . . .	.095	.024	
Hardness { Total	50.0	20.0	
{ Permanent	4.0	1.5	
Nitrates	Present	Nil	
Nitrites	Traces	Nil	
Poisonous metals	Nil (only iron in traces)	Nil	
Physical characters.			

Mineral analysis.

	I.	II.	III.
Calcium Carbonate	41.2	14.7	
„ Sulphate . . . . .	...	...
„ Chloride . . . . .	...	...
Magnesium Carbonate	6.0	3.5	
„ Sulphate	3.5	...	
„ Chloride . . . . .	...	...
Sodium Carbonate . . . . .	...	8.0	
„ Sulphate	120.6	1.4	
„ Chloride	21.5	4.8	
„ Nitrate	2.8	...	
Loss due to organic and volatile matter	2.4	1.6	
TOTAL	198.0	84.0	

Sample No. I is unfit both for drinking and boiler purposes.

Sample No. II is fit for both these purposes.

(Sd.)

L. M. AND S.,
Officiating Assistant Director,
Bombay, Dactl. Laboratory.

APPENDIX VI.

Economic Geology of Jhalawar State.

Among the features of the economic geology of Jhalawar State are some that call for special comment. *Building materials* are represented by limestones and sandstones of the Lower Vindhya system.

Limestone beds (argillaceous) are practically in-exhaustible and their average chemical composition inherently approximates to the ideal required in raw materials for the manufacture of Portland Cement of the highest quality. The deposit constitutes, for several miles, the Jhalawar Bank of the river Au, and rises to an average height of some 30 feet, the width of the bed being about 500 feet. Overburden is practically *nil*. The Government have under consideration a broad line from Pachpahar to a junction at Patan, from which a broad gauge siding would run direct into the limestone quarries. The quality and in-exhaustibility and low cost of quarrying of the stone, the adjacent abundant water supply, and its accessibility, render the deposit unique in the history of the manufacture of indigeneous cement. Under such favourable conditions an exceedingly remunerative return on the necessary capital outlay may be confidently relied upon, while the resultant cement should prove superior to present Indian and imported brand.

From the same beds, Hydraulic lime, substantially of the same composition as the well known Blue Lias Hydraulic Lime of England and also comparing favourably as regards physical properties, could also be successfully manufactured.

BERTRAM SMITH,
Queen's Prizeman,
late Chemist and Assistant Manager, Bund
Hydraulic Lime and Cement Company,
Limited, late Prospector for Messrs.
Bird and Company.

APPENDIX VII.

Details of cost of one mile of permanent-way.

(50 lbs. B. S. S. F., 36 feet long with 4 per cent. 33 feet and 2 per cent. 30 feet.)

Description.	Quantity.	Weight.	Unit.	Rate.	Amount.
	No.	Tons.		Rs.	Rs.
Rails, 50 lbs. F. F. B. S. S. 36 feet	236	78.58	Tons	168	13,200
Fish plates	811	3.18	"	220	700
Fish bolts and nuts	1,806	0.53	"	400	212
Dog spikes	9,800	2.63	"	300	780
Sleepers, half round, Jakoda Teak	2,000	...	each	3	6,000
Carriage to stores . . . . .	...	106.78	Tons	5	534
Loading and unloading . . . . .	...	106.78	"	1	107
Train haulage . . . . .	...	106.78	"	1	107
Laying and linking	1	...	Mile	200	200
Packing, lifting and boxing	1	...	"	150	150
Maintenance charges	1	...	"	250	250
Total cost of one mile of permanent-way .					22,249

Rates for Points and Crossings.

(50 lbs. F. F. B. S. S.)—

1 in 12 complete at Rs. 1,100 each.

1 in 8½ " " 780 "

APPENDIX VIII.

Cost of one mile of permanent-way 41½ lbs. F. F.

2 feet 6 inches gauge.

Particulars.	Weight.	Rate.	Per.	Amount.
	Tons.	Rs.		Rs.
1. Rails, steel, new, 41½ lbs., flat footed	64.80	130	Tons.	8,424
2. Fish plates	1.61	200	"	302
3. Fish bolts with nuts and washers	0.65	400	"	260
4. Dog spikes	3.15	350	"	1,103
Total	70.11	...	"	10,088
Add freight; 1665 miles at 4.08 pias per ton per mile, for first 400 miles and 2.72 pias per ton per mile, for remaining distance, on 70.11 tons—Rs. 26-6-3 per ton				1,852
Loading and unloading at Rs. 1 per ton				70
New Jakoda Teak, half round sleepers 2,000 at 2-8-0 each				5,000
Carriage of same, 366 miles at 4.08 pias per ton per mile for first 400 miles, and 2.72 pias per ton per mile, for remaining distance, on 41 tons—Rs. 7-12-6				340
Loading and unloading at Rs. 1 per ton on 41 tons				44
Laying and boxing at Rs. 300 per mile				300
Maintenance during construction				150
Total cost per mile				17,844

APPENDIX IX.

Cost of one mile of permanent-way, B. S. S. 60 lbs. 36 feet long with 4 per cent. 33 feet and 2 per cent. 30 feet.

Broad gauge, 5' 6".

Particulars.	Weight.	Rate.	Per.	Amount.
	Tons.	Rs.		Rs.
1. Rails, steel, new, B. S. S., F. F. 60 lbs. for broad gauge	94.29	130	Tons.	12,258
2. Fish plates (5 per cent. extra for waste)	4.58	200	"	916
3. Dog spikes (10 per cent. extra for wastage)	8.14	400	"	1,256
4. Fish bolts and nuts extra for wastage . . . . .	.93	350	"	326
Total	102.94	...	...	14,756
Add freight, 1,600 miles at 4.03 pies per ton mile for first 400 miles and 2.72 pies per ton mile for remaining distance on 102.94 tons				2,678
Loading and unloading at Re. 1 per ton				103
New Jodha Teak sleepers, 2,000 at Rs. 5 each				10,000
Carriage of same, 300 miles at 4.08 pies per ton mile				1,069
Loading and unloading at Re. 1 per ton on 167 tons				167
Laying and boxing, including lead to site				1,200
Maintenance during construction				500
		Total cost per mile		39,473
		" Say		39,500